Grade 6 Mathematics

Performance Level Descriptors

Introduction

The federal government requires states to adopt and assess standards and report assessment results using three or more levels. Federal guidance specifies that state's academic performance levels must include descriptions of the content-based competencies associated with each level. The descriptions, referred to as **Performance Level Descriptors (PLDs**), convey the degree of student achievement at each level. The Maryland Comprehensive Assessment Program (MCAP) Policy, Content, and Range PLDs are included in this document.

MCAP Policy Performance Level Descriptors

The MCAP Policy PLDS provide high-level descriptions of a student's ability to apply the knowledge and skills defined by the Maryland Content Standards for English Language Arts (ELA), Mathematics, Science, and Social Studies as demonstrated by their performance on MCAP assessments. Maryland elected to use the four performance levels, described below, when reporting assessment results.

Performance Level	MCAP Policy Performance Level Descriptors
4	**Distinguished Learners** demonstrate advanced proficiency. The students are well prepared for the next grade level or course and are well prepared for college and career readiness.
3	**Proficient Learners** demonstrate proficiency. The students are prepared for the next grade level or course and are on track for college and career readiness.
2	**Developing Learners** demonstrate partial proficiency. The students need additional academic support to ensure success in the next grade level or course and to be on track for college and career readiness.
1	**Beginning Learners** do not yet demonstrate proficiency. The students need substantial academic support to be prepared for the next grade level or course and to be on track for college and career readiness.

MCAP Mathematics Content Performance Level Descriptors

The results from each MCAP Mathematics assessment are reported using four performance levels. Mathematics Content PLDs for Grade 6 provide broad descriptions of what a student performing at each level means in terms of the mathematics content for the course.

Grade 6

Performance Level	MCAP Mathematics Content Performance Level Descriptors for Grade 6
4	**Distinguished Learners** demonstrate advanced proficiency in solving complex problems involving ratios, proportional relationships, the number system, equations, expressions, geometry, statistics, and probability, and demonstrates an ability to connect multiple grade-level concepts to conceptualize and apply mathematics to model, reason through, and solve problems efficiently, and relate mathematics to the real world.
3	**Proficient Learners** demonstrate proficiency in solving problems involving ratios, proportional relationships, the number system, equations, expressions, geometry, statistics, and probability, and demonstrates an ability to conceptualize and apply mathematics to model, reason through, and solve problems efficiently, and relate mathematics to the real world.
2	**Developing Learners** demonstrate partial proficiency in solving problems involving ratios, proportional relationships, the number system, equations, expressions, geometry, statistics, and probability, and may need some support in conceptualizing and applying mathematics to model, reason through, and solve problems efficiently, and in relating mathematics to the real world.
1	**Beginning Learners** do not yet demonstrate proficiency in solving problems involving ratios, proportional relationships, the number system, equations, expressions, geometry, statistics, and probability where the required mathematics is either directly indicated or uses common grade level procedure, and typically needs support in conceptualizing and applying mathematics to model, reason through, and solve problems efficiently, and in relating mathematics to the real world.

MCAP Mathematics Range Performance Level Descriptors

Range PLDs are grade/course specific descriptors of the cognitive and content level rigor expected at each performance level. The individual grade-level/course PLD documents provide robust descriptions associated with specific content. To show proficiency of the Maryland College and Career Readiness Standards, students must demonstrate their knowledge and skills as described by the Level 3 and Level 4 PLDs.

6.RP Ratios and Proportional Relationships

6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

6.RP.A.2 Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

b. Solve unit rate problems including those involving unit pricing and constant speed.

c. Find a percent of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percent.

d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Evidence Statement Code	Level 4 – Distinguished *A student performing at this level should be able to:*	Level 3 – Proficient *A student performing at this level should be able to:*	Level 2 – Developing *A student performing at this level should be able to:*	Level 1 – Beginning *A student performing at this level should be able to:*
6.RP.A.1 6.RP.A.2 6.RP.A.3	use ratio and rate reasoning to solve multi-step real-world and mathematical problems **that require connecting multiple grade-level concepts and integrating a variety of representations and strategies.**	use ratio and rate reasoning to solve **multi-step** real-world and mathematical problems **by creating and using a variety of** representations and strategies.	use ratio **and rate reasoning** to solve **real-world** problems and mathematical problems, given a **partially completed** representation of the problem.	use ratio reasoning to solve mathematical problems, with minimal or no context, given a representation of the problem.

6.NS Number System

6.NS.A Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.A.1 Interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

Evidence Statement Code	Level 4 – Distinguished *A student performing at this level should be able to:*	Level 3 – Proficient *A student performing at this level should be able to:*	Level 2 – Developing *A student performing at this level should be able to:*	Level 1 – Beginning *A student performing at this level should be able to:*
6.NS.A.1	divide fractions and mixed numbers with unlike denominators using efficient methods to solve **multi-step** real world problems.	divide fractions and mixed numbers with **like and unlike denominators** using **efficient methods (i.e. visual models, common denominator, standard algorithm, etc.)** to solve mathematical problems or real world problems.	divide fractions and **mixed numbers** with **easily related denominators (e.g. 3 and 6, 2 and 4)** using visual models **or common denominator method** to solve mathematical problems or **real world problems with prompting embedded.**	divide fractions with like denominators using visual models.
6.NS.A.1	**interpret the meaning of the quotient in mathematical and real world problems.**			

6.NS Number System

6.NS.B Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.B.2 Fluently divide multi-digit numbers using the standard algorithm.

6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

6.NS.B.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

Evidence Statement Code	Level 4 – Distinguished *A student performing at this level should be able to:*	Level 3 – Proficient *A student performing at this level should be able to:*	Level 2 – Developing *A student performing at this level should be able to:*	Level 1 – Beginning *A student performing at this level should be able to:*
6.NS.B.2 6.NS.B.3	apply distributive property, greatest common factor and least common multiple to solve **real-world** or mathematical problems and **interpret the meaning and reasonableness of an answer.**	add, subtract, multiply and divide **multi-digit decimals using the standard algorithm** to solve mathematical problems and **determine the reasonableness of an answer**	**multiply decimals, and divide multi-digit decimals with whole number divisors beyond the hundredths place, writing the remainder as a fraction or a decimal.**	add and subtract decimals with decimal places beyond the hundredths place.
6.NS.B.4		**use the distributive property to rewrite the sum of two whole numbers with a common factor as a multiple of a sum of two whole numbers with no common factor.**	find the **greatest** common factor or the **least** common multiple of two numbers.	find a common factor of two whole numbers less than or equal to 100 or a multiple of two numbers less than or equal to 12.

6.NS Number System

6.NS.C Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, and that 0 is its own opposite.

b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.C.7 Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.

b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.

c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

d. Distinguish comparisons of absolute value from statements about order.

6.NS.C.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

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6.NS.C.5 6.NS.C.6 6.NS.C.7 6.NS.C.8	represent, relate and/or interpret the rational numbers using mathematical models and/or symbols in order to make comparative statements and **write numerical expressions** in order to solve **complex** real-world and mathematical problems **that require connecting multiple grade-level concepts**.	represent, relate **and/or interpret** rational numbers using mathematical models and/or symbols in order to make comparative statements or to **solve real-world** and mathematical problems.	represent and/or relate **rational numbers using mathematical models and/or symbols in order to make comparative statements or to solve mathematical problems.**	represent and/or relate **rational numbers** using number lines and **integer ordered pairs** in the coordinate plane.
6.NS.C.5 6.NS.C.6 6.NS.C.8		**apply absolute value to solve problems involving distance and reflection.**	**use the coordinate plane to determine the distance between two points in order to solve mathematical problems.**	determine opposites and absolute values of rational numbers.

6.EE Expressions and Equations

6.EE.A Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents.

6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers.

a. Write expressions that record operations with numbers and with letters standing for numbers.

b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.

c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

6.EE.A.3 Apply the properties of operations to generate equivalent expressions.

6.EE.A.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).

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6.EE.A1 6.EE.A.2 6.EE.A.3 6.EE.A.4	**show or explain why expressions are equivalent using the properties of operations.**	**apply the order of operations to write** or evaluate numerical and algebraic expressions.	write or identify exponential expressions in equivalent forms (i.e. exponential form **with multiple bases**, expanded form, and standard form).	write exponential expressions in equivalent forms (i.e. exponential form with one common whole number base, expanded form, and standard form).
6.EE.A1 6.EE.A.2 6.EE.A.3 6.EE.A.4		**apply the properties of operations to generate or** identify equivalent numerical **and algebraic** expressions.	**apply two operations in order to write** or evaluate numerical expressions.	identify parts of an algebraic or numerical expression using precise mathematical vocabulary.
6.EE.A.4			identify equivalent numerical **and algebraic** expressions using properties of operations.	
6.EE.A.2			**translate between verbal expressions and mathematical expressions.**	

6.EE Expressions and Equations

6.EE.B Reason about and solve one-variable equations and inequalities.

6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

6.EE.B.8 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams

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6.EE.B.5 6.EE.B.6 6.EE.B.7	**analyze the meaning of solutions to an equation and inequality and defend whether the solution makes sense in real-world context.**	**write and** solve one-step equations with **nonnegative rational numbers** for real-world and mathematical problems.	**solve one-step equations with whole numbers for real-world and mathematical problems.** **translate between verbal expressions and mathematical expressions.**	use **substitution** to determine whether a given number in a specified set makes an equation true.
6.EE.B.5 6.EE.B.6 6.EE.B.8		**write inequalities and** represent solutions of **inequalities on number line diagrams**, **recognize that the inequalities have infinitely many solutions.**	use **substitution** to determine whether a given number in a specified set makes an **inequality** true.	compare rational numbers using relational symbols.
6.EE.B.6 6.EE.B.8		**write** an inequality **to represent a constraint or condition in a real world situation, and represent the solutions on a number line diagram**.	**given an inequality statement or graph, choose its corresponding representation.**	

6.EE Expressions and Equations

6.EE.C Represent and analyze quantitative relationship between dependent and independent variables.

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation.

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6.EE.C.9	write and solve equations resulting from real-world situations and **interpret the solution in context.**	**extend tables and graphs and/or write** equations to represent the relationship between dependent variables and independent variables, **in order to analyze and solve real-world problems.**	**identify an equation that represents a relationship between an independent variable and dependent variable.**	describe how the independent variable causes a change in the dependent variable within a scenario for relationships represented in a table or graph.

6.G Geometry

6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.A.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

6.G.A.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

6.G.A.4 Represent three-dimensional figures using nets made up of rectangles and triangles and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

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6.G.A.1	solve real-world problems involving finding the area of **complex polygons** by composing and/or decomposing into other shapes.	solve **real-world problems** involving area of polygons by composing and/or decomposing **into other shapes.**	solve mathematical problems involving area of **polygons by composing and/or decomposing into triangles and rectangles.**	use formulas to find the area of triangles and rectangles with whole number and fractional side lengths.
6.G.A.2	find the volume of a **compound figure** composed of right rectangular prisms to solve mathematical and real-world problems.	**solve mathematical and real-world problems by finding a missing dimension in a rectangular prism.**	find the volume of right rectangular prisms with fractional edge lengths by packing them with unit cubes **and/or using formulas.**	find the volume of a right rectangular prism **with fractional edge lengths** by packing with unit cubes.
6.G.A.3	**solve problems that require connecting multiple grade-level concepts** involving polygons in the coordinate plane.	use coordinates of vertices to find the length of sides in a polygon and **apply these techniques in the context of solving real-world and mathematical problems.**	**use the coordinates of the vertices of a polygon to find the length of a side joining points with the same first coordinate or the same second coordinate.**	draw polygons in the coordinate plane given coordinates for the vertices.
6.G.A.4	**find the surface area of composite three-dimensional figures** to solve mathematical and real-world problems.	use nets and area formulas to find the surface area or **to find missing dimensions** to solve mathematical and **real-world problems.**	**use nets and area formulas to find the surface area of three-dimensional figures.**	identify a three-dimensional figure based on its net and given measurements, or identify the net of a three-dimensional figure with given dimensions.

6.SP Statistics and Probability

6.SP.A Develop understanding of statistical variability.

6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.A.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

6.SP.B Summarize and describe distributions.

6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.
b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Evidence Statement Code	Level 4 – Distinguished *A student performing at this level should be able to:*	Level 3 – Proficient *A student performing at this level should be able to:*	Level 2 – Developing *A student performing at this level should be able to:*	Level 1 – Beginning *A student performing at this level should be able to:*
6.SP.A 6.SP.B	**interpret and justify the reasonableness of measures of center, measures of variability, and use of statistical displays within a given context.**	**build appropriate statistical displays; calculate** measures of center and **measures of variability** to describe the overall shape of a statistical display.	calculate measures of center, **and use a measure of center, spread, and overall shape to describe a given statistical display.**	calculate the measures of center for a single data set. identify a statistical question.

Reasoning Performance Level Descriptors

All reasoning assessment items connect to both the Grade 6 reasoning evidence statements and the content evidence statements.

Students must provide evidence of their ability to reason mathematically by responding to:

- one-point machine scored items. For one-point reasoning items, refer to the associated content PLDs.
- four-point constructed response items. For four-point reasoning items, refer to both the reasoning PLDs below and the associated content PLDs.

Reasoning Evidence Statements

6.R.1 Reasoning with Ratios

6.R.1a Present solutions to multi-step problems in the form of valid chains of reasoning, using symbols such as the equal sign appropriately, or identify or describe errors in solutions to multi-step problems and present corrected solutions.

6.R.2 Reasoning with Number Systems

6.R.2a Base arithmetic explanations and reasoning on concrete referents such as diagrams, connecting the diagrams to a written (symbolic) method.

6.R.2b Base explanations and reasoning on the relationship between multiplication and division.

6.R.2c Base explanations and reasoning on a number line diagram.

6.R.2d Base explanations and reasoning on a coordinate plane diagram.

6.R.3 Reasoning with Expressions and Equations

6.R.3a Base explanations and reasoning on the properties of operations.

6.R.3b Given an equation, present the solution steps as a logical argument that concludes with a solution.

6.R.3c Form chains of reasoning that will justify or refute propositions or conjectures.

6.R.3d Present solutions to multi-step problems in the form of valid chains of reasoning, adhering to precision. Identify or describe errors in solutions to multi-step problems and present corrected solutions.

Level 4 – Distinguished *A student performing at this level should be able to provide evidence of mathematical reasoning by communicating:*	**Level 3 – Proficient** *A student performing at this level should be able to provide evidence of mathematical reasoning by communicating:*	**Level 2 – Developing** *A student performing at this level should be able to provide evidence of mathematical reasoning by communicating:*	**Level 1 – Beginning** *A student performing at this level should be able to provide evidence of mathematical reasoning by communicating:*
a sophisticated chain of reasoning.	a well-developed chain of reasoning.	a partially developed, valid chain of reasoning.	the beginning of a chain of reasoning.
a precise, logical solution pathway.	a logical solution pathway that may contain minor flaws.	a solution pathway that contains some correct processes yielding an incorrect solution.	an attempted solution pathway.
an extensive command of mathematical representations and vocabulary.	a proficient command of mathematical representations and vocabulary.	an understanding of some mathematical representations and vocabulary.	a developing understanding of some mathematical representations and vocabulary.

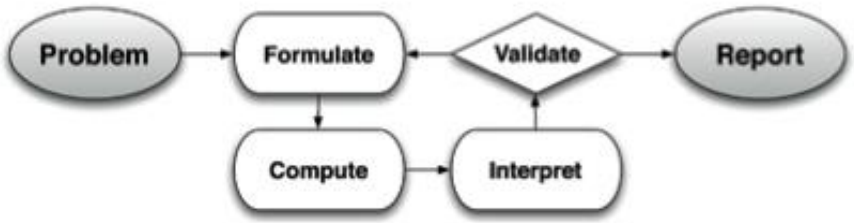
Modeling Performance Level Descriptors

All modeling assessment items connect to both the Grade 6 modeling evidence statements and the content evidence statements.

Students must provide responding to:

- one-point machine scored items. For one-point modeling items, refer to the associated content PLDs.
- four-point constructed response items. For four-point modeling items, refer to both the modeling PLDs below and the associated content PLDs.

Modeling Cycle



Modeling Evidence Statements

6.M Modeling with Mathematics in Grade 6

6.M.1 Choose and produce appropriate mathematics to model quantities and mathematical relationships in order to analyze situations, make predictions, solve multi-step problems, and draw conclusions.

- 6.M.1a Given a real-world situation, identify the problem that needs to be solved, make necessary assumptions, and identify important information.
- 6.M.1b Given a real-world situation, formulate a mathematical representation of the problem.
- 6.M.1c Given a real-world situation, use mathematical models to compute and draw conclusions.
- 6.M.1d Given a real-world situation, interpret what a solution means within the context of the situation.
- 6.M.1e Given a real-world situation, evaluate and/or validate a partial or complete solution.

Level 4 – Distinguished *A student performing at this level should be able to provide evidence of the ability to use the modeling cycle by:*	**Level 3 - Proficient** *A student performing at this level should be able to provide evidence of the ability to use the modeling cycle by:*	**Level 2 - Developing** *A student performing at this level should be able to provide evidence of the ability to use the modeling cycle by:*	**Level 1 - Beginning** *A student performing at this level should be able to provide evidence of the ability to use the modeling cycle by:*
determining the information or mathematics needed to solve a problem that requires connecting multiple grade-level concepts.	determining needed information or mathematics.	identifying needed information or mathematics.	identifying some needed information or mathematics.
communicating an accurate, organized solution path aligned to the problem using appropriate, effective, and precise representations.	communicating an accurate, organized solution path aligned to the problem using appropriate, effective, and precise representations that may contain minor flaws.	communicating a partial solution path that may contain mathematical errors.	communicating the beginning of a solution path, containing mathematical errors.
evaluating or validating a solution path or showing how to improve a model or correct a given solution.	evaluating or validating a solution path or showing how to improve a model, but work may include minor flaws.	partially validating a solution path or incorrectly improving the model.	attempting to validate a solution path.