Colorado Measures of Academic Success

CMAS Grade 6 Mathematics Frameworks

Concepts and skills explicitly identified in the Colorado Academic Standards (CAS) are the basis for the Colorado Measures of Academic Success (CMAS) assessment. CMAS Mathematics Frameworks list the percent representation and number of score points for each of the reporting categories and standards areas that appear on the summative assessments. They also specify the Evidence Outcomes that are included on the state assessments. The Prepared Graduate Statements in the CAS, or the Standards for Mathematical Practice (SMP), provide the basis for Subclaims C and D, Reasoning and Modeling tasks. These tasks are based on grade-level math standards and securely held knowledge from the previous grade level. Reasoning tasks engage in practices reflected in Prepared Graduate Statements SMP 3, Construct Viable Arguments and Critique the Reasoning of Others, and SMP 6, Attend to Precision. Modeling tasks engage in the practices reflected in SMP 4, Model with Mathematics. Each Content Standard is assessed in each grade level.

Reporting Category	Colorado Academic Standards Summative Assessment Framework-FINAL Math Grade 6	% of Score Points of Total Test	Points
Subclaim A	**Major Content**	**39-40**	**20**
	Number and Quantity **Grade Level Expectation: 6.RP.A. Ratios & Proportional Relationships: Understand ratio concepts and use ratio reasoning to solve problems.** **Evidence Outcomes:** 1. Apply the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was* $2:1$*, because for every* 2 *wings there was* 1 *beak." "For every vote Candidate* A *received, Candidate* C *received nearly three votes."* (CCSS: 6.RP.A.1) 2. Apply 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. *For example, "This recipe has a ratio of* 3 *cups of flour to* 4 *cups of sugar, so there is* $\frac{3}{4}$ *cup of flour for each cup of sugar." "We paid $75 for* 15 *hamburgers, which is a rate of $5 per hamburger." (Expectations for unit rates in this grade are limited to non-complex fractions.)* (CCSS: 6.RP.A.2) 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. (CCSS: 6.RP.A.3) 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. (CCSS: 6.RP.A.3.a) b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took* 7 *hours to mow* 4 *lawns, then at that rate, how many lawns could be mowed in* 35 *hours? At what rate were lawns being mowed?* (CCSS: 6.RP.A.3.b) c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percent. (CCSS: 6.RP.A.3.c) d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. (CCSS: 6.RP.A.3.d)		

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	Grade Level Expectation: 6.NS.A. The Number System: Apply and extend previous understandings of multiplication and division to divide fractions by fractions. **Evidence Outcomes:** 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. *For example, create a story context for* $\frac{2}{3} \div \frac{3}{4}$ *and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that* $\frac{2}{3} \div \frac{3}{4} = \frac{8}{9}$ *because* $\frac{3}{4}$ *of* $\frac{8}{9}$ *is* $\frac{2}{3}$*. (In general,* $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$*.) How much chocolate will each person get if* 3 *people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{3}{4}$*-cup servings are in* $\frac{2}{3}$ *of a cup of yogurt? How wide is a rectangular strip of land with length* $\frac{3}{4}$ *mi and area* $\frac{1}{2}$ *square mi?* (CCSS: 6.NS.A.1)		
	Grade Level Expectation: 6.NS.C. The Number System: Apply and extend previous understandings of numbers to the system of rational numbers. **Evidence Outcomes:** 5. Explain why positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (CCSS: 6.NS.C.5) 6. Describe 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. (CCSS: 6.NS.C.6) a. Use opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; identify that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite. (CCSS: 6.NS.C.6.a) b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; explain that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. (CCSS: 6.NS.C.6.b) 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. (CCSS: 6.NS.C.6.c) 7. Order and find absolute value of rational numbers. (CCSS: 6.NS.C.7) a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret* $-3 > -7$ *as a statement that* -3 *is located to the right of* -7 *on a number line oriented from left to right.* (CCSS: 6.NS.C.7.a)		

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	b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write* $-3°\text{C} > -7°\text{C}$ *to express the fact that* $-3°\text{C}$ *is warmer than* $-7°\text{C}$. (CCSS: 6.NS.C.7.b) c. Define 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. *For example, for an account balance of* -30 *dollars, write* $\lvert -30\rvert = 30$ *to describe the size of the debt in dollars.* (CCSS: 6.NS.C.7.c) d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than* -30 *dollars represents a debt greater than* 30 *dollars.* (CCSS: 6.NS.C.7.d) 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. (CCSS: 6.NS.C.8)		
	Algebra and Functions		
	Grade Level Expectation: 6.EE.A. Expressions & Equations: Apply and extend previous understandings of arithmetic to algebraic expressions. **Evidence Outcomes:** 1. Write and evaluate numerical expressions involving whole-number exponents. (CCSS: 6.EE.A.1) 2. Write, read, and evaluate expressions in which letters stand for numbers. (CCSS: 6.EE.A.2) a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract* y *from* 5*" as* $5 - y$. (CCSS: 6.EE.A.2.a) 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. *For example, describe the expression* $2(8 + 7)$ *as a product of two factors; view* $(8 + 7)$ *as both a single entity and a sum of two terms.* (CCSS: 6.EE.A.2.b) 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). *For example, use the formulas* $V = s^3$ *and* $A = 6s^2$ *to find the volume and surface area of a cube with sides of length* $s = \frac{1}{2}$. (CCSS: 6.EE.A.2.c) 3. Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression* $3(2 + x)$ *to produce the equivalent expression* $6 + 3x$*; apply the distributive property to the expression* $24x + 18y$ *to produce the equivalent expression* $6(4x + 3y)$*; apply properties of operations to* $y + y + y$ *to produce the equivalent expression* $3y$. (CCSS: 6.EE.A.3)		

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	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). *For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.* (CCSS: 6.EE.A.4)		
	Grade Level Expectation: 6.EE.B. Expressions & Equations: Reason about and solve one-variable equations and inequalities. **Evidence Outcomes:** 5. Describe 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. (CCSS: 6.EE.B.5) 6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; recognize that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (CCSS: 6.EE.B.6) 7. Solve real-world and mathematical problems by writing and solving equations of the form $x \pm p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. (CCSS: 6.EE.B.7) 8. Write an inequality of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ to represent a constraint or condition in a real-world or mathematical problem. Show that inequalities of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. (CCSS: 6.EE.B.8)		
	Grade Level Expectation: 6.EE.C. Expressions & Equations: Represent and analyze quantitative relationships between dependent and independent variables. **Evidence Outcomes:** 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. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.* (CCSS: 6.EE.C.9)		
Subclaim B	**Supporting Content**	**22**	**11**
	Number and Quantity		
	Grade Level Expectation: 6.NS.B. The Number System: Compute fluently with multi-digit numbers and find common factors and multiples. **Evidence Outcomes:** 2. Fluently divide multi-digit numbers using the standard algorithm. (CCSS: 6.NS.B.2)		

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	3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. (CCSS: 6.NS.B.3) 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. *For example, express* $36 + 8$ *as* $4(9 + 2)$. (CCSS: 6.NS.B.4)		
	Data, Statistics, and Probability		
	Grade Level Expectation: 6.SP.A. Statistics & Probability: Develop understanding of statistical variability. **Evidence Outcomes:** 1. Identify a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.* (CCSS: 6.SP.A.1) 2. Demonstrate that a set of data collected to answer a statistical question has a distribution that can be described by its center, spread, and overall shape. (CCSS: 6.SP.A.2) 3. Explain 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. (CCSS: 6.SP.A.3)		
	Grade Level Expectation: 6.SP.B. Statistics & Probability: Summarize and describe distributions. **Evidence Outcomes:** 4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (CCSS: 6.SP.B.4) 5. Summarize numerical data sets in relation to their context, such as by: (CCSS: 6.SP.B.5) a. Reporting the number of observations. (CCSS: 6.SP.B.5.a) b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. (CCSS: 6.SP.B.5.b) 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. (CCSS: 6.SP.B.5.c) 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. (CCSS: 6.SP.B.5.d)		

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	Geometry **Grade Level Expectation: 6.G.A. Geometry: Solve real-world and mathematical problems involving area, surface area, and volume.** **Evidence Outcomes:** 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. (CCSS: 6.G.A.1) 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. (CCSS: 6.G.A.2) 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. (CCSS: 6.G.A.3) 3. 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. (CCSS: 6.G.A.4)		
Subclaim C	**Expressing Mathematical Reasoning**	**20-22**	**10-11**
	Base explanations/reasoning on the properties of operations. Content Scope: Knowledge and skills articulated in 6.EE.3, 6.EE.4		
	Base explanations/reasoning on the relationship between addition and subtraction or the relationship between multiplication and division. Content Scope: Knowledge and skills articulated in 6.NS.1		
	Base explanations/reasoning on a number line diagram (whether provided in the prompt or constructed by the student in their response). Content scope: Knowledge and skills articulated in 6.NS.6, 6.NS.7		
	Base arithmetic explanations/reasoning on concrete referents such as diagrams (whether provided in the prompt or constructed by the student in her response), connecting the diagrams to a written (symbolic) method. Content Scope: Knowledge and skills articulated in 6.NS.1		
	Base explanations/reasoning on a coordinate plane diagram (whether provided in the prompt or constructed by the student in their response). Content Scope: Knowledge and skills articulated in 6.NS.6, 6.NS.8		

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	Given an equation, present the solution steps as a logical argument that concludes with a solution. Content Scope: Knowledge and skills articulated in 6.EE.B		
	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. Content Scope: Knowledge and skills articulated in 6.EE.4		
	Present solutions to multi-step problems in the form of valid chains of reasoning, using symbols such as equals signs appropriately (for example, rubrics award less than full credit for the presence of nonsense statements such as 1 + 4 = 5 + 7 = 12, even if the final answer is correct), or identify or describe errors in solutions to multi-step problems and present corrected solutions. Content Scope: Knowledge and skills articulated in 6.RP.A, 6.EE.9		
	Distinguish correct explanation/reasoning from that which is flawed, and – if there is a flaw in the argument – present corrected reasoning. (For example, some flawed 'student' reasoning is presented and the task is to correct and improve it.) Content Scope: Knowledge and skills articulated in 5.NBT, 5.MD.C		
Subclaim D	**Modeling and Application**	**18**	**9**
	Solve multi-step contextual word problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in Sub-Claim A Evidence Statements.		
	Solve multi-step contextual problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in 5.NBT.B, 5.NF, 5.MD, and 5.G.A		
	Reasoned estimates: Use reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity. Content Scope: Knowledge and skills articulated in Sub-Claim A Evidence Statements.		
All Subclaims	**Calculator Usage**		
	Calculator	72-73	36-37
	Non-Calculator	27-28	13-14
	Total	**100**	**50-51**