Colorado Measures of Academic Success

CMAS Grade 7 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 7	% of Score Points of Total Test	Points
Subclaim A	**Major Content**	**45-46**	**23**

Number and Quantity

Grade Level Expectation: 7.RP.A. Ratios & Proportional Relationships: Analyze proportional relationships and use them to solve real-world and mathematical problems.

Evidence Outcomes:

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units. *For example, if a person walks* $\frac{1}{2}$ *mile in each* $\frac{1}{4}$ *hour, compute the unit rate as the complex fraction* $\frac{\frac{1}{2}}{\frac{1}{4}}$ *miles per hour, equivalently* 2 *miles per hour.* (CCSS: 7.RP.A.1)
2. Identify and represent proportional relationships between quantities. (CCSS: 7.RP.A.2)
   a. Determine whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. (CCSS: 7.RP.A.2.a)
   b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. (CCSS: 7.RP.A.2.b)
   c. Represent proportional relationships by equations. *For example, if total cost* t *is proportional to the number* n *of items purchased at a constant price* p*, the relationship between the total cost and the number of items can be expressed as* $t = pn$*.* (CCSS: 7.RP.A.2.c)
   d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0,0)$ and $(1, r)$ where r is the unit rate. (CCSS: 7.RP.A.2.d)
3. Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.* (CCSS: 7.RP.A.3)

Grade Level Expectation: 7.NS.A. The Number System: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Evidence Outcomes:

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. (CCSS: 7.NS.A.1)
   a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has* 0 *charge because its two constituents are oppositely charged.* (CCSS: 7.NS.A.1.a)

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	b. Demonstrate $p+q$ as the number located a distance $\lvert q \rvert$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. (CCSS: 7.NS.A.1.b) c. Demonstrate subtraction of rational numbers as adding the additive inverse, $p-q=p+(-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. (CCSS: 7.NS.A.1.c) d. Apply properties of operations as strategies to add and subtract rational numbers. (CCSS: 7.NS.A.1.d) 2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. (CCSS: 7.NS.A.2) a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1)=1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. (CCSS: 7.NS.A.2.a) b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-\left(\frac{p}{q}\right)=\frac{-p}{q}=\frac{p}{-q}$. Interpret quotients of rational numbers by describing real-world contexts. (CCSS: 7.NS.A.2.b) c. Apply properties of operations as strategies to multiply and divide rational numbers. (CCSS: 7.NS.A.2.c) d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. (CCSS: 7.NS.A.2.d) 3. Solve real-world and mathematical problems involving the four operations with rational numbers. *(Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)* (CCSS: 7.NS.A.3)		
	Algebra and Functions		
	Grade Level Expectation: 7.EE.A. Expressions & Equations: Use properties of operations to generate equivalent expressions. **Evidence Outcomes:** 1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. (CCSS: 7.EE.A.1)		

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	2. Demonstrate that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example,* $a + 0.05a = 1.05a$ *means that "increase by* 5%*" is the same as "multiply by* 1.05*."* (CCSS: 7.EE.A.2)		
	Grade Level Expectation: 7.EE.B. Expressions & Equations: Solve real-life and mathematical problems using numerical and algebraic expressions and equations. **Evidence Outcomes:** 3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making* $\$25$ *an hour gets a* 10% *raise, she will make an additional* $\frac{1}{10}$ *of her salary an hour, or* $\$2.50$*, for a new salary of* $\$27.50$*. If you want to place a towel bar* $9\frac{3}{4}$ *inches long in the center of a door that is* $27\frac{1}{2}$ *inches wide, you will need to place the bar about* 9 *inches from each edge; this estimate can be used as a check on the exact computation.* (CCSS: 7.EE.B.3) 4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (CCSS: 7.EE.B.4) a. Solve word problems leading to equations of the form $px \pm q = r$ and $p(x \pm q) = r$, where *p*, *q*, and *r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is* 54 *cm. Its length is* 6 *cm. What is its width?* (CCSS: 7.EE.B.4.a) b. Solve word problems leading to inequalities of the form $px \pm q > r$, $px \pm q \geq r$, $px \pm q < r$, or $px \pm q \leq r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid* $50 *per week plus* $3 *per sale. This week you want your pay to be at least* $100. *Write an inequality for the number of sales you need to make and describe the solutions.* (CCSS: 7.EE.B.4.b)		

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Subclaim B	**Supporting Content**	**16**	**8**
	Data, Statistics, and Probability		
	Grade Level Expectation: 7.SP.A. Statistics & Probability: Use random sampling to draw inferences about a population. **Evidence Outcomes:** 1. Understand that statistics can be used to gain information about a population by examining a sample of the population; explain that generalizations about a population from a sample are valid only if the sample is representative of that population. Explain that random sampling tends to produce representative samples and support valid inferences. (CCSS: 7.SP.A.1) 2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.* (CCSS: 7.SP.A.2)		
	Grade Level Expectation: 7.SP.B. Statistics & Probability: Draw informal comparative inferences about two populations. **Evidence Outcomes:** 3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is* 10 *cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.* (CCSS: 7.SP.B.3) 4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.* (CCSS: 7.SP.B.4)		
	Grade Level Expectation: 7.SP.C. Statistics & Probability: Investigate chance processes and develop, use, and evaluate probability models. **Evidence Outcomes:** 5. Explain that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. (CCSS: 7.SP.C.5)		

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	6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube* 600 *times, predict that a* 3 *or* 6 *would be rolled roughly* 200 *times, but probably not exactly* 200 *times.* (CCSS: 7.SP.C.6) 7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (CCSS: 7.SP.C.7) a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* (CCSS: 7.SP.C.7.a) b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?* (CCSS: 7.SP.C.7.b) 8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. (CCSS: 7.SP.C.8) a. Explain that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. (CCSS: 7.SP.C.8.a) b. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event. (CCSS: 7.SP.C.8.b) c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If* 40% *of donors have type A blood, what is the probability that it will take at least* 4 *donors to find one with type A blood?* (CCSS: 7.SP.C.8.c)		
	Geometry		
	Grade Level Expectation: 7.G.A. Geometry: Draw, construct, and describe geometrical figures and describe the relationships between them. **Evidence Outcomes:** 1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. (CCSS: 7.G.A.1)		

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	2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. (CCSS: 7.G.A.2) 3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in cross sections of right rectangular prisms and right rectangular pyramids. (CCSS: 7.G.A.3)		
	Grade Level Expectation: 7.G.B. Geometry: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. **Evidence Outcomes:** 4. State the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (CCSS: 7.G.B.4) 5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multistep problem to write and solve simple equations for an unknown angle in a figure. (CCSS: 7.G.B.5) 6. Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (CCSS: 7.G.B.6)		
Subclaim C	**Expressing Mathematical Reasoning**	**20-22**	**10-11**
	Base explanations/reasoning on the properties of operations. Content Scope: Knowledge and skills articulated in 7.NS.1, 7.NS.2, 7.EE.1		
	Base explanations/reasoning on the relationship between addition and subtraction or the relationship between multiplication and division. Content Scope: Knowledge and skills articulated in 7.NS.1, 7.NS.2		
	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 7.NS.A		
	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 7.RP.A		
	Given an equation, present the solution steps as a logical argument that concludes with the set of solutions (if any). Content Scope: Knowledge and skills articulated in 7.EE.4a		
	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. Content Scope: Knowledge and skills articulated in 7.RP.2		

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	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 7.RP.3, 7.NS.2d, 7.NS.3, 7.EE.3		
	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. Content Scope: Knowledge and skills articulated in 6.NS.C, 6.EE.A, 6.EE.B		
Subclaim D	**Modeling and Application**	**18**	**9**
	Solve multi-step contextual word problems with degree of difficulty appropriate to Grade 7, 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 7, requiring application of knowledge and skills articulated in 6.RP.A, 6.EE.C, 6.G.		
	Micro-models: Autonomously apply a technique from pure mathematics to a real-world situation in which the technique yields valuable results even though it is obviously not applicable in a strict mathematical sense (e.g., profitably applying proportional relationships to a phenomenon that is obviously nonlinear or statistical in nature). Content Scope: Knowledge and skills articulated in Sub-Claim A Evidence Statements		
	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	76	38-39
	Non-Calculator	24	12
	Total	**100**	**50-51**