CSAP Mathematics

Assessment Framework

Grade 10

ASSESSMENT FRAMEWORK– *defines what will be assessed on the State's paper and pencil, standardized, timed assessment (CSAP). This document is organized as follows:*

Standard	Indicates the broad knowledge and skills that all students should be acquiring in Colorado schools for the grade level indicated. Each standard is assessed every year.	
Benchmark	Tactical description of the knowledge and skills students should acquire within each grade level range (i.e., K-4, 5-8, or 9-12).	
Assessment Objectives	a	Specific knowledge and skills measured by CSAP for each grade level assessed. Assessment Objectives are assessed on a cyclical basis.

Note*: The appearance of an * behind a word or phrase indicates it appears in the glossary of the Colorado Model Content Standards for Mathematics.*

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UNIT OF STUDENT
ASSESSMENT

Grade 10 Math
Standards/Assessment Frameworks

Standard 1	Students develop number sense* and use numbers and number relationships in problem-solving situations* and communicate the reasoning used in solving these problems.	
Benchmark 1	Demonstrate meanings for real numbers*, absolute value*, and scientific notation* using physical materials and technology in problem-solving situations*.	
Assessment Objectives	a	Compare and order sets of real numbers*.
	b	Recognize and use equivalent representations of real numbers* in a variety of forms including scientific notation*, radicals, and other irrational numbers* such as π.
	c	Use very large and very small numbers in real life situations to solve problems (for example, understanding the size of the national debt).
Benchmark 2	Develop, test, and conjectures* about the properties of number systems and sets of numbers.	
Assessment Objectives	a	Develop and test conjectures* about the properties of the real number system and common subsets of the real number system (for example, counting numbers, integers*, rationals).
	b	Verify and apply the properties of the operation "to the power of".
Benchmark 3	Use number sense* to estimate and justify the reasonableness of solutions to problems involving real numbers*.	
Assessment Objectives	a	Use number sense* to estimate and justify the reasonableness of solutions to problems involving real numbers*.

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10th Grade MATH

UNIT OF STUDENT
ASSESSMENT

Grade 10 Math
Standards/Assessment Frameworks

Standard 2	Students use algebraic methods* to explore, model*, and describe patterns* and functions* involving numbers, shapes, data, and graphs in problem-solving situations*and communicate the reasoning used in solving these problems.	
Benchmark 1	Model* real world phenomena (for example, distance-versus-time relationships, compound interest, amortization tables, mortality rates) using functions*, equations, inequalities, and matrices*.	
Assessment Objectives	a	Model* real world phenomena involving linear, quadratic and exponential relationships using multiple representations of rules that can take the form of a recursive process, a function*, an equation, or an inequality.
Benchmark 2	Represent functional relationships using written explanations, tables, equations, and graphs and describe the connections among these representations.	
Assessment Objectives	a	Represent functional relationships using written explanations, tables, equations, and graphs, and describe the connections among these representations.
	b	Convert from one functional representation to another.
	c	Interpret a graphical representation of a real-world situation.
Benchmark 3	Solve problems involving functional relationships using graphing calculators and/or computers as well as appropriate paper-and-pencil techniques.	
Assessment Objectives	a	Solve problems involving functions* and relations using calculators, graphs, tables, and algebraic methods*.
	b	Solve simple systems of equations using algebraic, graphical or numeric methods.
	c	Solve equations with more than one variable* for a given variable (for example, solve for p in 1= prt or for r in C=2πr).

cde

10th Grade MATH

UNIT OF STUDENT
ASSESSMENT

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 4		Analyze and explain the behaviors, transformations*, and general properties of types of equations and functions* (for example, linear*, quadratic*, exponential*).	
Assessment Objectives	a	Identify and interpret x- and y- intercepts in the context of a problem.	
	b	Using a graph, identify the maximum and minimum value within a given domain.	
	c	Demonstrate horizontal and vertical translations* on graphs of functions* and their meanings in the context of a problem.	
	d	Recognize when a relation is a function*.	
Benchmark 5		Interpret algebraic equations and inequalities geometrically and describe geometric relationships algebraically.	
Assessment Objectives	a	Graph solutions to equations and inequalities in one-and two-dimensions.	
	b	Express the perimeter, area and volume* relationships of geometric figures algebraically.	
	c	Describe geometric relationships algebraically.	
Standard 3		Students use data collection and analysis, statistics*, and probability* in problem-solving situations* and communicate the reasoning used in solving these problems.	
Benchmark 1		Design and conduct a statistical experiment to study a problem, and interpret and communicate the results using the appropriate technology (for example, graphing calculators, computer software).	
Assessment Objectives	a	Identify factors which may have affected the outcome of a survey (for example, biased questions or collection methods).	

cde

A
UNIT OF STUDENT
ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

	b	Draw conclusions about a large population based upon a properly chosen random sample.
	c	Select and use an appropriate display to represent and describe a set of data (for example, scatter plot*, line graph and histogram).
Benchmark 2	Analyze statistical claims for erroneous conclusions or distortions.	
Assessment Objectives	a	Check a graph, table or summary for misleading characteristics.
	b	Recognize the misuse of statistical data in written arguments.
	c	Describe how data can be interpreted in more than one way or be used to support more than one position in a debate.
	d	Describe how the responses to a survey can be affected by the way the questions are phrased and/or by the reader's bias.
Benchmark 3	Fit curves to scatter plots* using informal methods or appropriate technology to determine the strength of the relationship between two data sets and to make predictions.	
Assessment Objectives	a	Graph data sets, create a scatter plot*, and identify the control (independent) variable and dependent variable.
	b	Determine a line of best fit from a scatter plot* using visual techniques.
	c	Predict values using a line of best fit.
	d	Show how extrapolation may lead to faulty conclusions.
	e	Recognize which model, linear or nonlinear, fits the data most appropriately.

cde

A
UNIT OF STUDENT
ASSESSMENT

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 4	Draw conclusions about distributions of data based on analysis of statistical summaries (for example, the combination of mean and standard deviation, and differences between the mean and median).	
Assessment Objectives	a	Differentiate between mean, median, and mode and demonstrate the appropriate use of each.
	b	Recognize and classify various types of distributions (for example, bimodal, skewed, uniform, binomial, normal).
	c	Use the mean and standard deviation to determine relative positions of data points in a normal distribution of authentic data.
	d	Demonstrate how outliers might affect various representations of data and measures of central tendency*.
Benchmark 5	Use experimental and theoretical probability* to represent and solve problems involving uncertainty (for example, the chance of playing professional sports if a student is a successful high school athlete).	
Assessment Objectives	a	Determine the probability* of an identified event using the sample space.
	b	Distinguish between experimental and theoretical probability* and use each appropriately.
	c	Differentiate between independent and dependent events to calculate the probability* in real-world situations*.
	d	Calculate the probability* of event A **and** B occurring and the probability* of event A **or** B occurring.
	e	Use area models to determine probability* (for example, the probability* of hitting the bull's eye region in a target).

cde

UNIT OF STUDENT ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 6		Solve real-world problems* with informal use of combinations* and permutations* for example, determining the number of possible meals at a restaurant featuring a given number of side dishes).
Assessment Objectives	a	Apply organized counting techniques to determine combinations* and permutations* in problem-solving situations*.
Standard 4		Students use geometric concepts, properties, and relationships in problem-solving situations* and communicate the reasoning used in solving these problems.
Benchmark 1		Find and analyze relationships among geometric figures using transformations* (for example, reflections*, translations*, rotations*, dilations*) in coordinate systems*.
Assessment Objectives	a	Describe and apply the properties of similar and congruent* figures.
	b	Solve problems involving symmetry* and transformations*.
	c	Use coordinate geometry* and/or tessellations to solve problems.
	d	Describe cylinders, cones and spheres that result from the rotation* of rectangles, triangles and semicircles about a line.
Benchmark 2		Derive and use methods to measure perimeter, area, and volume* of regular and irregular geometric figures.
Assessment Objectives	a	Use the Pythagorean Theorem and its converse to solve real-world problems*.
	b	Use properties of polygons to find areas of regular and irregular figures.
	c	Use properties of geometric solids to find volumes and surface areas of regular and irregular geometric solids.

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9/15/2005

A
UNIT OF STUDENT ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 3		Make and test conjectures* about geometric shapes and their properties, incorporating technology where appropriate.
Assessment Objectives	a	Make and test conjectures* about geometric shapes and their properties to include parallelism and perpendicularity, numerical relationships on a triangle, relationships between triangles, and properties of quadrilaterals and regular polygons.
	b	Apply geometric relationships such as parallelism and perpendicularity, numerical relationships on a triangle, relationships between triangles, and properties of quadrilaterals and regular polygons to solve problems.
Benchmark 4		Use trigonometric ratios* in problem-solving situations* (for example, finding the height of a building from a given point, if the distance to the building and the angle of elevation are known).
Assessment Objectives	a	Use right triangle trigonometry* to solve real-world problems*.
Standard 5		Students use a variety of tools and techniques to measure, apply the results in problem-solving situations*, and communicate the reasoning used in solving these problems.
Benchmark 1		Measure quantities indirectly using techniques of algebra*, geometry*, or trigonometry*.
Assessment Objectives	a	Use appropriate measurements to solve problems indirectly (for example, find the height of a flagpole using similar triangles.
	b	Use measurement to solve real-world problems* involving rate of change (for example, distance traveled using rate and time).
	c	Given the rate of change, model* real-world problems* algebraically or graphically.
	d	Describe how changing the measure of one attribute of a geometric figure affects the other measurements.

cde

UNIT OF STUDENT ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 2	Select and use appropriate tools and techniques to measure quantities in order to achieve specified degrees of precision, accuracy and error (or tolerance) of measurements.	
Assessment Objectives	a	Select and use appropriate tools and techniques to measure quantities in order to achieve specified degrees of precision, accuracy, and error of measurements.
	b	Given commonly used multi-dimensional figures, determine what units and measurements need to be taken.
Benchmark 3	Determine the degree of accuracy of a measurement (for example, by understanding and using significant details).	
Assessment Objectives	a	Determine the number of significant digits when measuring and calculating with those measurements.
Standard 6	Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic*, paper-and-pencil, calculators, and computers, in problem-solving situations* and communicate the reasoning used in solving these problems.	
Benchmark 1	Use ratios, proportions, and percents in problem-solving situations*.	
Assessment Objectives	a	Use ratios, proportions, and percents in problem-solving situations* that involve rational numbers*.
	b	Convert from one set of units to another using proportions (for example, feet/minute to miles/hour).
	c	Apply direct variation to problem-solving situations*.

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9/15/2005

A
UNIT OF STUDENT
ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

Benchmark 2	Select and use appropriate ~~methods~~ *algorithms** for computing with real numbers* in problem-solving situations*~~from among mental arithmetic*, estimation, paper-and-pencil, calculator, and computer methods,~~ and determine whether the results are reasonable.
Assessment Objectives	a Apply appropriate computational methods to solve multi-step problems involving all types of numbers from the real number system.
Benchmark 3	Describe the limitations of estimation and assessing the amount of error resulting from estimation within acceptable tolerance limits.
Assessment Objectives	a Determine when estimation is an appropriate method to solve a problem and describe what error might result from estimation.

Beyond the CSAP

This section identifies additional knowledge and abilities to promote math development for students continuing their mathematics education beyond the CSAP measured standards.

Standard 1	Students develop number sense* and use numbers and number relationships in problem-solving situations* and communicate the reasoning used in solving these problems.
	Investigate limiting processes by examining infinite sequences and series.
	Explain relationships among real numbers, complex numbers*, and vectors* using models.
Standard 2	Students use algebraic methods* to explore, model*, and describe patterns* and functions* involving numbers,

cde

UNIT OF STUDENT ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

	shapes, data, and graphs in problem-solving situations*and communicate the reasoning used in solving these problems.	
	Use rational, polynomial, trigonometric, and inverse functions to model real-world phenomena.	
	Represent and solve problems using linear programming and difference equations.	
	Solve systems of linear equations using matrices and vectors.	
	Describe the concept of continuity of a function.	
	Perform operations on and between functions.	
	Make the connections between trigonometric functions and polar coordinates, complex numbers, and series.	
Standard 3	Students use data collection and analysis, statistics*, and probability* in problem-solving situations* and communicate the reasoning used in solving these problems.	
	Create and interpret discrete and continuous probability distributions, and understanding their application to real-world situations (for example, insurance).	
	Test hypotheses using appropriate statistics.	
	Explore the effect of sample size on the results of statistical surveys using experiments and simulations.	
	Solve real-world problems with formal use of combinations and permutations.	
Standard 4	Students use geometric concepts, properties, and relationships in problem-solving situations* and communicate the reasoning used in solving these problems.	
	Deduce properties of figures using vectors*.	

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9/15/2005

A
UNIT OF STUDENT
ASSESSMENT

10th Grade MATH

Grade 10 Math
Standards/Assessment Frameworks

		Apply transformations, coordinates, and vectors in problem-solving situations.
		Describe, analyze, and extend patterns produced by processes of geometric change (for example, limits and fractals).
Standard 5		Students use a variety of tools and techniques to measure, apply the results in problem-solving situations*, and communicate the reasoning used in solving these problems.
		Demonstrate the meanings of area under a curve and length of an arc.
Standard 6		Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic*, paper-and-pencil, calculators, and computers, in problem-solving situations* and communicate the reasoning used in solving these problems.
		Analyze and solve optimization problems*.
		Analyze different algorithms (for example, sorting) for efficiency.
		Analyze and use critical path algorithms (for example, determining in which order to perform a set of tasks in a large project).
		Investigate problem situations that arise in connection with computer validation and the application of algorithms.

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A

UNIT OF STUDENT
ASSESSMENT

10th Grade MATH