California Assessment of
Student Performance and Progress

Grade 11

Teacher Guide

Acknowledgments

The Teacher Guide to the Smarter Balanced Summative Assessments: Mathematics, Grade Eleven was developed by California Department of Education staff, with support from the California Teachers Association, the California Federation of Teachers, the Smarter Balanced Assessment Consortium, and WestEd. It was designed and prepared for printing by San Joaquin County Offce of Education.

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Introduction

The purpose of the Teacher Guide is to deepen teachers' understanding of the Smarter Balanced Summative Assessments, their alignment with the California Common Core State Standards (CA CCSS), and their intended connection to classroom learning. The guide for mathematics is grade-span specifc and synthesizes key information from a wide array of resources and resource sites, including:

- California Common Core State Standards
- California Mathematics Framework for California Public Schools: Kindergarten through Grade Twelve (Mathematics Framework)
- Content, item, task, and stimulus specifcations
- Smarter Balanced Test Blueprints
- Smarter Balanced Practice Test Scoring Guides
- Smarter Balanced Communication Tools
- Smarter Balanced Digital Library

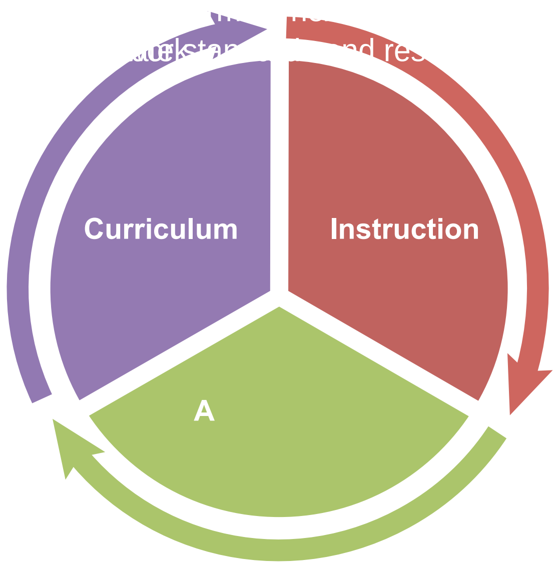
The mathematics guides are organized by grade span to highlight the changes in expectations as students move through the grade levels. Within the guides there are examples from Smarter Balanced Item Specifcations that explain how student skills and knowledge are assessed and reported through collecting and scoring evidence. This grades three through fve guide has an example from Claim 1, Concepts and Procedures, Grade Five. The grades six through eight guide shows a specifcation for Claim 3, Communicating Reasoning, Grade Eight, and the grade eleven guide shows an example from Claim 4, Modeling and Data Analysis. The guide also provides examples of the range and types of items that appear on the assessments and the multiple resources

- Designed to measure the expectations embodied in the CA CCSS adopted by the California State Board of Education in August 2010
- Emphasize deeper knowledge of core concepts and ideas within and across the disciplines along with analysis, synthesis, problem solving, communication, and critical thinking
- Include a greater variety of item types
- Capitalize on the strengths of computer adaptive testing (CAT), such as eff cient and precise measurement across the full range of achievement
- Provide greater opportunities for classroom teachers to inf uence the design and operation of the assessment system

Section One: Purpose of the Guide—Resource for Planning Learning Events to Implement the Mathematics Framework for California Public Schools for Kindergarten through Grade Twelve Public Schools

These Teacher Guides are intended to be a resource for classroom teachers as they plan learning activities that fully implement the California Mathematics Framework using assessment feedback from the Smarter Balanced system of assessments.

Figure 1. Curriculum, Instruction, and Assessment Feedback Loop



Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve

The first stop for teachers in planning learning events is the Mathematics Framework. The guidance in this resource is research-based and includes practical examples to help all teachers.

Guiding Principles behind the development of the *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (2015):[1]

- Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.

> **The Smarter Connection**
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> Smarter Balanced math assessments use a variety of item types and performance assessment tasks to challenge students in multiple ways. The items and tasks are reviewed by teachers to make sure they will engage the student's curiosity and encourage them to dig deeper for innovative solutions to uncommon problems.

Tasks should be designed to challenge students in multiple ways. Short- and long-term investigations that connect procedures and skills with conceptual understanding are integral components of an effective mathematics program. Activities should build upon students' curiosity and prior knowledge and enable them to solve progressively deeper, broader, and more sophisticated problems.[2]

Guiding Principle 2: Teaching

An effective mathematics program is based on a carefully designed set of content VWDQGDUGV WKDW DUH FOHDU DQG VSHFL¿F IRFXVHG DQ coherent sequence.

The sequence of topics and instruction should be based on what is known about how students' mathematical knowledge, skill, and understanding develop over time. What and how students are taught should refect not only the topics within mathematics but also the key ideas that determine how knowledge is organized and generated within mathematics.

Mathematical problem solving is the hallmark of an effective mathematics program. Skill in mathematical problem solving requires practice with a variety of mathematical problems as well as a frm grasp of mathematical techniques and their underlying principles. Armed with this deeper knowledge, students can use mathematics in fexible ways to attack various problems and devise different ways to solve any particular problem.

> **The Smarter Connection**
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> Smarter Balanced worked with the Common Core authors to build a tight alignment to the grade by grade learning progressions and the priority and supporting standards tested at each grade. Students highlight their skill in problem solving through the performance assessment task that combines problems to build a solution that is clearly communicated with suffcient evidence.

2 Ibid. page 4

Mathematical problem solving calls for refective thinking, persistence, learning from the ideas of others, and reviewing one's own work with a critical eye. Students should be able to construct viable arguments and critique the reasoning of others. They should analyze situations and justify their conclusions, communicate their conclusions to others, and respond to the arguments of others.[3]

Guiding Principle 3: Technology

Technology is an essential tool that should be used strategically in mathematics education.

Technology enhances the mathematics curriculum in many ways. Tools such as measuring instruments, manipulatives (such as base-ten blocks and fraction pieces), scientifc and graphing calculators, and computers with appropriate software, if properly used, contribute to a rich learning environment for investigating, exploring, developing, and applying mathematical concepts. Appropriate use of calculators is essential; calculators should not be used as a replacement for basic understanding and skills. Elementary students should learn how to perform the basic arithmetic operations independent of the use of a calculator (National Center for Education Statistics 1995). The use of a graphing calculator can help middle school and secondary students visualize properties of functions and their graphs. Graphing calculators should be used to enhance—not replace—student understanding and skills.

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Innovative items have been developed specifcally for the Smarter Balanced assessments to engage students in real-world scenarios with multiple modes of response. All mathematics tools, including calculators, are embedded in the testing software. Test sections may be designed with "No Calculator" to conform to the Smarter Balanced calculator use policy that implements the intent of the Common Core State Standards.

Technology changes the mathematics to be learned, as well as when and how it is learned. For example, currently available technology provides a dynamic and exploration-driven approach to mathematical concepts such as functions, rates of change, geometry, and averages that was not possible in the past.[4]

3 Ibid. page 4

4 Ibid. page 5

Assessments take a variety of forms, require different amounts of time, and address various aspects of student learning. Gaps in knowledge and errors in reasoning can be identifed when students “think aloud” or talk through their reasoning. By observing and questioning students as they work, teachers can gain insight into students’ abilities to apply appropriate mathematical concepts and skills, make conjectures, and draw conclusions.

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Smarter Balanced Interim Assessments and formative assessment resources in the Digital Library support teachers to identify gaps in student knowledge and gain insight into student thinking. Partnerships with mathematics teachers and researchers continue to enhance the professional learning and instructional resources that support effective classroom-based assessment.

Assessment should also be a major component of the learning process. As students help identify goals for lessons or investigations, they gain greater awareness of what they need to learn and how they will demonstrate that learning. Engaging students in this kind of goal setting can help them refect on their work, understand the standards to which they are held accountable, and take ownership of their learning.[6]

Learning in the 21st Century

In supporting 21st century learning, California is part of a growing national movement to teach students the problem-solving skills and critical thinking they need for college, careers, and civic life. The Partnership for 21st Century Skills (P21) developed a framework for 21st century learning comprising student outcomes and support systems. The student outcomes consist of the following elements:

- Core subjects and 21st century interdisciplinary themes, which include global awareness; fnancial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy
- Life and career skills, which include fexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility

6 Ibid. page 7

- Learning and innovation skills, often referred to as the “4 Cs”: creativity and innovation, critical thinking and problem solving, communication, and collaboration
- Information, media, and technology skills, which include information literacy, media literacy, and ICT (information, communications, and technology) literacy.

Support systems provided by P21 include standards and assessments, curriculum and instruction, professional development, and learning environments.[7]

The Mathematics Framework guiding principles are important to keep in mind when planning learning activities. Daily opportunities to engage in rich learning using 21st century skills keep students engaged and develop students as partners in their own learning.

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Smarter Balanced performance assessment tasks were designed to meet the requirements of 21st century learning. The topics are real-world examples of issues that engage students. The performance tasks (PTs) are designed to elicit evidence of critical thinking, creative thinking, and consideration of the local and global impact of the issues.

7 Ibid. page 7

Section Two: Understanding and Using Smarter Balanced Test Design Principles to Support Classroom Learning Events

This section describes the evidence-centered design of the Smarter Balanced assessments and the hierarchical approach to item development. There are examples of how the test developers and teachers use evidence to accurately assess the learning required by the CA CCSS. Connecting the use of evidence-centered design and classroom learning activities allows a strong connection between Smarter Balanced results and resources.

Understanding the Fundamentals of Smarter Balanced Design

Knowing how the Smarter Balanced assessment system is developed, particularly how items are developed, can be helpful in understanding how to make the best use of the assessment resources and results. This knowledge should facilitate increasing the intentional connection between curriculum, instruction, and assessment.

The CA CCSS in Mathematics include content standards and standards for mathematical practice. In order to fully align the assessment to all of these standards, the Smarter Balanced test design has grade-level priority and supporting content clusters as assessment targets for Claim 1. For Claims 2, 3, and 4, the standards for mathematical practice emphasized at each claim and grade level are the assessment targets. (See the Mathematics Summative Assessment Blueprint on the Smarter Balanced Development and Design Web page at http://www.smarterbalanced.org/assessments/development/, under the Summative Test Blueprints tab, for grade-by-grade assessment targets in all claims.) The performance task in each grade uses priority content to frame a multi-step task and collect evidence on the student's ability to use content knowledge and mathematical practices effectively to solve the problems and communicate the rationale with supporting evidence.

The diagram and charts on the following pages describe the structure of Smarter Balanced item specifications—how evidence-centered design is used to develop items. A mathematics, grade eleven example is used here from claim 4. While it is certainly not necessary to memorize this information, having a working knowledge of item development can facilitate use of results to enhance learning events. This item specification information is available for all Smarter Balanced assessments in resources listed at the end of this document.

Smarter Balanced has provided a zip file for each Claim and Grade of the item specifications used by test item writers to develop questions which can be found on the Smarter Balanced Development and Design Web page at http://www.smarterbalanced.org/assessments/development/ under the Item and Task Specification tab. You will be able to see exactly what instructions were given to clarify what was being tested and how to make sure there was tight alignment to the standards being assessed. The priority and supporting/additional domains and clusters tested in Claim 1 have statements describing evidence required to demonstrate deep understanding of the standards. In Claims 2, 3, and 4, the Standards for Mathematical Practice are being tested in the context of real-world problems. For these claims, the item specifications describe expectations for students to provide evidence of the ability to apply mathematical practices to solve problems.

When you open the link above, you will see a list of zip files. Choose the grade and claim you are interested in. For example, we have provided excerpts from a Claim 4, Grade Eleven specification here. Once you open the zip file, look for the assessment target. In our example in Figure 4 we are using assessment target E. We chose E because on the test design (blueprint) for Grade eleven on the CAT, students receive one question covering targets B and E.

To illustrate the importance of evidence-centered design, Figure 3 displays the relationship among the overall claims, sub-domain assessment claims, assessment targets, and academic standards. This relationship is important, not only in the design and development of the Smarter Balanced items, but also in the interpretation and reporting of scores.

This claim/target/standard relationship is clearly articulated through the steps of the evidence-centered design model that Smarter Balanced assessments employ. The first step in the evidence-centered design approach is to define the content domains to be measured; in this case, the domains are English language arts/literacy and mathematics. The next step is to define the assessment claims that will be made about the domains. Claims are arguments derived from evidence about college and career readiness; Smarter Balanced claims are statements about what a student knows and is able to do. In the Smarter Balanced system, there are two kinds of claims: an “overall claim,” corresponding to performance on the entire assessment of English language arts/literacy or mathematics, and four domain-specific claims corresponding to performance in different areas in each of the assessments.

Figure 3. Relationship Among Overall Claims, Sub-Domain Assessment Claims, Assessment Targets and Standards

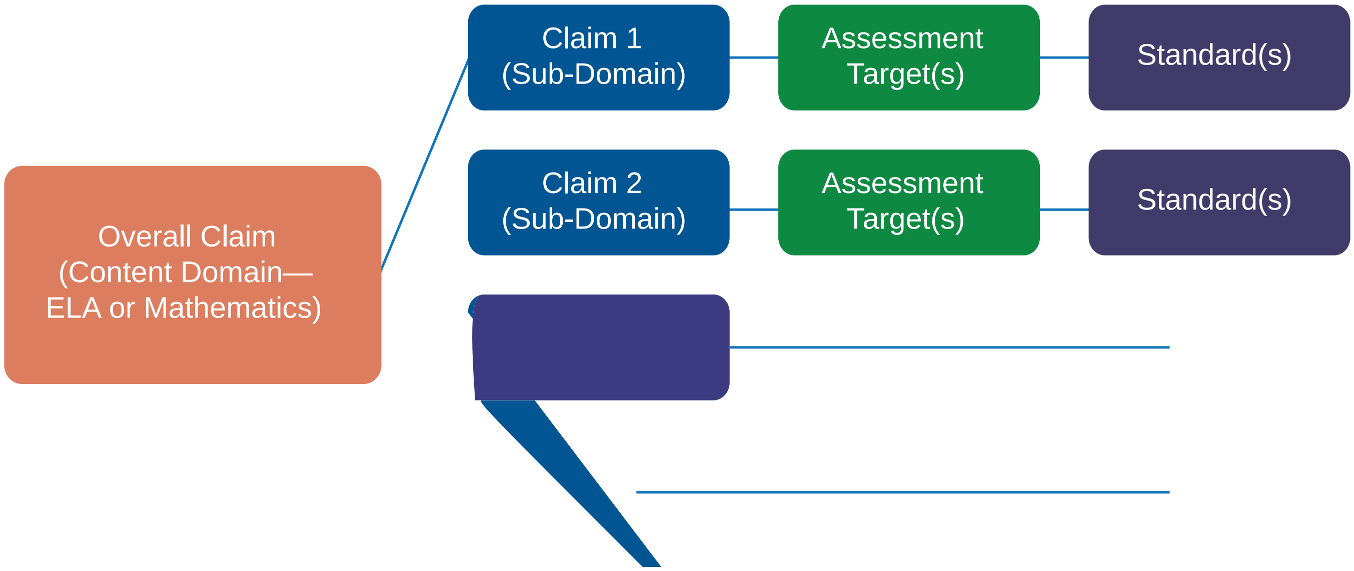

Figure 3a. Anatomy of a Test—The Hierarchy of the Smarter Balanced Summative Assessments

Example – Mathematics – Grade Eleven

Overall Math Claim for Grade 11	Math Claim 4	Domain(s)	Estimated Number of Items Per Claim	Targets are the bridge between the content standards and the assessment evidence that supports the claim; they ensure sufficiency of evidence to justify each claim	Associated Standard(s) and Depth of Knowledge (DOK)(s)*
Students can demonstrate college and career readiness in Mathematics	Students cananalyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.	A, F, G, N, S	4–6 items	Target E Analyze the adequacy of and make improve-ments to an existing model or develop a mathematical model of a real phenomenon.	N-Q.A A-SSE.B A-CED.A A-REI.A A-REI.B A-REI.C F-IF.B F-IF.C F-BF.A S-ID.A S-ID.B S-IC.A.1 S-IC.B F-LE.A F-LE.B F-TF.B.5 G-GMD.A.3 G-MG.A DOK 1,2,3,4

* The Common Core State Standards require high-level cognitive demand. The Depth of Knowledge (DOK) refers to the cognitive rigor required of students to answer a question or perform a task. Four levels of DOK are considered in Smarter Balanced assessments, with each level requiring greater cognitive demand.

Connecting the Smarter Balanced Mathematics Assessments to Classroom Learning

By examining the item specifications for Modeling and Data Analysis, Claim 4 (See Figure 4), teachers will be able to connect the evidence required in a Smarter Balanced assessment to learning goals and success criteria for a classroom learning event aligned to particular standards from mathematics Claim 4. The item specifications in

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What Smarter Balanced resources may a teacher consider in planning learning events for students in priority clusters and supporting clusters that integrate the Standards for Mathematical Practices?

Claim 1 detail the ways students will be tested on the deep understanding of the domains and clusters. The Development Notes of the Item Specifications describe appropriate approaches to using the same domain and cluster standards in problems to test the application of mathematical practices in Claims 2, 3, and 4. For a complete picture of an integrated approach to learning events with multiple entry points and opportunities for students to demonstrate evidence of deep understanding, cross-reference all of the grade level item specifications related to a domain and cluster in all of the Claims. (See Development Notes in Figure 4). The Smarter Balanced Item Specifications are a complex but necessary guiding resource as educators begin to analyze results. The specifications are a rich resource of information that includes the following:

- Intended claim (of what is being measured)
- Specific CA CCSS standards that are measured and connections to related standards in the grade below and the grade above
- Task models with example problems
- Types of items allowed
- Types of accommodations allowed
- Depth of knowledge, and
- Statements of evidence required of students

Often teachers want to know, “How good is good enough?” To give guidance to[illegible] wr[illegible]s, Smar[illegible] Balanced developed Range Achievement Level Descriptors (ALDs) for each grade, claim, and assessment target. These descriptions of what students should be able todo at each level of performance may guide the development of classroom rubrics and operationalize the expectations from the assessments. See the example in Figure 4:

: K D W V X I ¿ F L H Q W evidence looks like for Claim 4 (Modeling and Data Analysis) [8]	"A key feature of items and tasks in Claim 4 is that the student is confronted with a contextualized, or 'real world' situation and must decide which information is relevant and how to represent it. As some of the examples provided below illustrate, 'real world' situations do not necessarily mean questions that a student might really face; it means that mathematical problems are embedded in a practical application context. In this way, items and tasks in Claim 4 differ from those in Claim 2, because while the goal is clear, the problems themselves are not yet fully formulated (well-posed) in mathematical terms.

Standards
N-Q.A
A-SSE.B
A-CED.A
A-REI.A
A-REI.B
A-REI.C
F-IF.B
F-IF.C
F-BF.A
S-ID.A
S-ID.B
S-IC.A.1
S-IC.B
F-LE.A
F-LE.B
F-TF.B.5
G-GMD.A.3
G-MG.A

Number and Quantities – Quantities (N-Q)

N-Q.A	Reason quantitatively and use units to solve problems
N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra – Seeing Structure in Expressions (A-SSE)

A-SSE.B	Write expressions in equivalent forms to solve problems
A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.[9] a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be UHZULWWHQ DV W B§ W WR UHYHDO equivalent monthly interest rate if the annual rate is 15%.
A-SSE.B.4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments

Algebra – Creating Equations (A-CED)

A-CED.A	Create equations that describe numbers or relationships
A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

9 All standards with a “star” are measured only on performance tasks.

Standards (continued)	A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, fnd the points of intersection between the line y = –3x and the circle x2 + y2 = 3.
	A-REI.C.8	(+) Represent a system of linear equations as a single matrix equation in a vector variable.
	A-REI.C.9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).
		Functions – Interpreting Functions (F-IF)
	F-IF.B	Interpret functions that arise in applications in terms of the context
	F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
	F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.
	F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specifed interval. Estimate the rate of change from a graph.
	F-IF.C	Analyze functions using different representations
	F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defned functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Standards (continued)		e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
	F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
		a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
		b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such D V \ W \ W \ W \ W as representing exponential growth or decay.
	F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
		Functions – Building Functions (F-BF)
	F-BF.A	Build a function that models a relationship between two quantities
	F-BF.A.1	Write a function that describes a relationship between two quantities.
		a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
		b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
		c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather

Standards (continued)		Functions – Trigonometric Functions (F-TF)
		Model periodic phenomena with trigonometric functions
	F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specifed amplitude, frequency, and midline.
		Geometry
	G-GMD.A	Explain volume formula and use them to solve problems
	G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
	G-MG.A	Apply geometric concepts in modeling situations
	G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
	G-MG.A.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
	G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
		Statistics and Probability – Interpreting Categorical and Quantitative Data (S-ID)
	S-ID.A	Summarize, represent, and interpret data on a single count or measurement variable
	S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
	S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
	S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
	S-ID.A.4	Use the mean and standard deviation of a data set to ft it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
	S-ID.B	Summarize, represent, and interpret data on two categorical and quantitative variables

Standards (continued)	S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
	S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.
		Statistics and Probability – Making Inferences and Justifying Conclusions
	S-IC.A	Understand and evaluate random processes underlying statistical experiments
	S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
	S-IC.B	Make inferences and justify conclusions from sample surveys, experiments, and observational studies
	S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
	S-IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
	S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
	S-IC.B.6	Evaluate reports based on data.
Depth of Knowledge	DOK 3,4	

Range Achievement Level Descriptors (ALD)	Level 1 Students should be able toidentify important quantities in the context of a familiar situation and translate words to equations or other mathematical formulation. When given the correct math tool(s), students should be able to apply the tool(s) to problems with a high degree of scaffolding. Level 2 Students should be able to identify important quantities in the context of an unfamiliar situation and to select tools to solve a familiar and moderately scaffolded problem or to solve a less familiar or a non-scaffolded problem with partial accuracy. Students should be able to provide solutions to familiar problems using an appropriate format (e.g., correct units, etc.). They should be able to interpret information and results in the context of a familiar situation. Level 3 Students should be able to map, display, and identify relationships, use appropriate tools strategically, and apply mathematics accurately in everyday life, society, and the workplace. They should be able to interpret information and results in the context of an unfamiliar situation. Level 4 Students should be able to analyze and interpret the context of an unfamiliar situation for problems of increasing complexity and solve problems with optimal solutions.
General Task Model Expectations for Target 4E	Tasks used to assess this target ask students to investigate the efficacy of existing models (e.g., develop a way to analyze the claim that a child's height at age 2 doubled equals his/her adult height) and suggest improvements using their own or provided data. Other tasks for this target will ask students to develop a model for a particular phenomenon (e.g., analyze the rate of global ice melt over the past several decades and predict what this rate might be in the future). Longer constructed response items and extended performance tasks should be used to assess this target.
Allowable Response Types	Multiple-Choice, single correct response(MC); Multiple Choice, multiple correct response (MS); Equation/Numeric (EQ); Drag and Drop, Hot Spot, and Graphing (GI); Matching Tables (MA); Fill-in Table (TI) No more than six choices in MS and MA items. Short Text – Performance tasks and select CAT items.
Allowable Stimulus Materials	Effort must be made to minimize the reading load in problem situations. Use tables, diagrams with labels, and other strategies to lessen reading load. Use simple subject-verb-object (SVO) sentences; use contexts that are familiar and relevant to all or most students at the targeted grade level. Target specific stimuli will be derived from the Claim 1 targets used in the problem situation.
Construct-Relevant Vocabulary	

Allowable Tools	Any mathematical tools appropriate to the problem situation and the Claim 1 target(s). Some tools are identifed in Standard for Mathematical Practice 5 and others can be found in the language of specifc standards.
7DUJHW 6SHFLÀF Attributes	CAT items should take from 3 to 8 minutes to solve; Claim 4 items that are part of a performance task may take 5 to 15 minutes to solve.
Accessibility Guidance	Item writers should consider the following Language and Visual Element/Design guidelines when developing items. Language Key Considerations: • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references Visual Elements/Design Key Considerations: • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics Items are selected for a student’s test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.

Smarter Balanced Assessment Evidence Statements Describe Learning Expectations

The Smarter Balanced assessments are designed to gather evidence from students that

Figure 5. Suggested Process to Identify Expectations Requirements

Example Item 4E.1b:

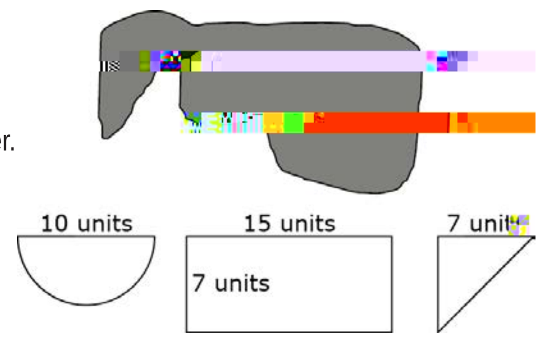
Primary Target 4E (Content Domain G-MG), Secondary Target 1X (G-MG.1), Tertiary Target 4C

A researcher models the area of the surface of a pond using a rectangle, a semi-circle, and an isosceles triangle.

Drag each shape onto the scale diagram of the pond to show how the model fts.

Explain whether the researcher's model will estimate an area greater than, equal to, or less than the actual area of the pond's surface.

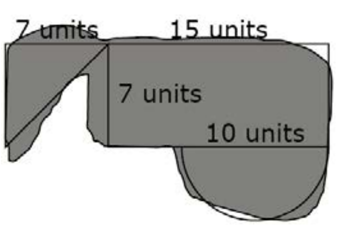
Use specifc examples and mathematics to support your answer.



Interaction: The student drags the objects from the palette and places them on top of the pond to approximate the area.

Rubric: (2 points) The student is able to drag the shapes onto the pond in a way to model the best possible ft and make the determination that the pond is slightly larger than the combined areas of the three shapes. The student must supply an explanation that adjusts for the difference in size by either determining the areas of the shapes with specifc values or stating how the pond is larger than the combined shapes by a certain portion of one of the shapes (e.g., the triangle needed to be about 2 units longer). (1 point) The student is able to place the shapes onto the pond in a way to model the best possible ft, but is not able to draw a correct conclusion or support the conclusion.

Exemplar [10]: The area of the pond is slightly greater than the combined area of the three shapes. The semi-circle is the best ft, with a only small amount of the pond extending out the right side, but that is accounted for because of the gap between the pond and the semi-circle at the bottom left side. The rectangle is a good match to the main portion of the pond. However, the triangle is smaller than the remaining portion of the pond. Given the combined area of the three shapes is about 39.3 + 105 +24.5 or 168.8 sq units, I would estimate the pond to be about 175 sq units.



Response Type: Drag and Drop and Short Text (hand scored)

10 An exemplar response represents only one possible solution. Typically, many other solutions/responses may receive full credit. The full range of acceptable responses is determined during range fnding and/or scoring validation.

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Evidence Statements to Design a Lesson or Activity

assessment as well as large-scale statewide assessment. The Mathematics Framework distinguishes between assessment for learning and assessment of learning.[11] An annual summative assessment, like the Smarter Balanced Summative Assessment, is an assessment of learning; while it does not provide teachers with immediate, actionable feedback on student learning, it can provide educators with valuable information to enhance the teaching and learning process, as well as provide a valid and reliable measure of achievement at the student, school, district, and state levels.

In contrast, assessment for learning, or formative assessment, occurs during instruction, allowing teachers to adapt instruction as needed. Teaching with the formative assessment process includes challenging students with rigorous tasks. Lessons with formative assessments clarify the student learning goals and success criteria and elicit evidence of student understanding. As teachers interpret this evidence, instruction may be adjusted to optimize learning. Learning is accomplished when students demonstrate

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As part of the test development process, Smarter Balanced held cognitive labs in participating states (including California). Students were asked to talk about what they were thinking when they answered trial test questions. This way, test developers could determine if the students were actually thinking about what the question writers intended when students answered the question. Using results from the cognitive labs, the student responses confrmed that the sample questions were at the correct level of rigor and deep understanding of the standard being tested. The labs also validated the usefulness of the technology tools for students with special needs, the ability of early elementary students to use the keyboard to manipulate the technology tools, and other critical concerns addressed by the computer-based delivery of the test.

Teachers are able to make use of the Smarter Balanced CAT items and performance tasks presented on the Practice Test to see how the collection of evidence from each question adds evidence to support all the claims in an integrated and coherent approach. These Practice Tests may be used in a whole group setting, or even used as starting points for creating classroom items or performance tasks. Teachers can gain an understanding of how the combination of evidence adds to the overall evaluation of student understanding of the math domains and clusters as a whole. With this understanding, teachers may construct their own classroom models for collecting evidence that align pieces of evidence to each standard being assessed.

The Smarter Connection

Figure 7 provides a side-by-side comparison between the Major Principles of the California Common Core State Standards in Mathematics and the elements of the Smarter Balanced test design that support these shifts

Figure 7. Side by Side Comparison of the Major Principles of the California Common Core State Standards in Mathematics [9] and Smarter Balanced Test Design [10]

California Common Core State Standards in Mathematics Focus	Smarter Balanced Test Design Focus
Place strong emphasis where the standards focus	There are grade-level specifc blueprints that detail

Item and Task Types Collect Evidence in New Ways

The Smarter Connection

The new Smarter Balanced Summative Assessments elicit greater, more precise evidence of a student's knowledge, reasoning, and understanding.

Section Four: Using Smarter Balanced Score Reports to Analyze Data and Improve Learning

The third step in the feedback loop is to analyze the student data trends to evaluate the learning that has occurred by the students. Teachers compare the curriculum intended for learning by students with the curriculum actually learned as evidenced by the results on multiple measures, including the Smarter Balanced assessments. Teachers look at multiple sources of data, including individual results and class data to understand the "big picture" of student learning.

For Smarter Balanced results, each student's score is placed on a continuous scale that is able to show growth from year to year. With class-level data, teachers may identify strengths and gaps of understanding in the content areas which can lead to adjustments in the teaching and learning cycle.

The Smarter Connection

What do the results on the Smarter Balanced Assessments (summative and interim) indicate about student strengths and needs?

The Smarter Balanced assessments are designed to assess student learning at a point in time, using technology to eliminate accessibility barriers and maximize the opportunity for students to show what they know. The computer adaptive software is a critical design aspect allowing students to answer questions at an appropriate level of diffculty to collect positive evidence of knowledge that leads to an accurate score for each student.

Computer Adaptive Testing: Appropriate Assessment for Each Student

In computer adaptive testing (CAT), the computer program adjusts the diffculty of questions on the basis of student responses. For example, a student who answers a question correctly will receive a subsequent question that is more challenging, while an incorrect answer will generate a less challenging question. This approach represents a signifcant improvement over traditional paper-and-pencil assessments, in which all students receive the same test items, and provides teachers and schools with a more accurate way to evaluate student achievement and measure growth over time.

Practice Tests and Training Tests Available for Teachers, Students, and Parents

Teachers are able to use sample student responses and the Smarter Balanced Practice Test Scoring Guides to find comparisons to student work in their own classes or from

Overall Score and Achievement Level— 6KRZV 6WXGHQW 3HUIRUPDQFH RQ WKH 'LI¿FXOW\ 6FDO

Students receive an overall scale score for Mathematics. On the mathematics assessment, Claim 1, Concepts and Procedures, is 50% of the overall score; Claims 2 and 4, Problem-solving, Modeling, and Data Analysis, are reported together for 25% of the score; and Claim 3, Communicating Reasoning is the remaining 25% of the overall score. The score falls along a continuous vertical scale (from approximately 2,000 to 3,000) that increases across grade levels. Based on this score, a student is determined to be at one of four achievement levels.

Let's consider the Mathematics scale score range for grade eleven, which spans over fve hundred points:

2,280 ⟷ 2,862

Within that range, there are four distinct achievement levels, as shown in Figure 10:

Figure 10. Grade Eleven Mathematics Scale Scores and Achievement Levels

Standard Not Met	Standard Nearly Met	Standard Met	Standard Exceeded
2280–2542	2543–2627	2628–2717	2718–2862

The achievement levels take into account the level of diffculty of the test questions. Because the test is computer adaptive, students who consistently answer correctly will be steered toward items at the higher end of the continuum, allowing for the opportunity to achieve at the Standard Exceeded level. Those who consistently answer incorrectly will be steered toward the lower end, possibly resulting in the Standard Not Met level. Regardless of the level, the score provides an accurate refection of performance against a set of academic standards and performance expectations.

For example, teachers may look at grade-level

The Smarter Connection

The Smarter Balanced Summative Assessment results help teachers develop lines of inquiry to improve the curriculum, enhance the teaching and learning cycle, and make learning more meaningful to students.

data to observe the trends of students toward each end of the diffculty continuum. If groups of students, on average, have met or exceeded the standards, there is evidence that the classroom learning events helped students practice applying deep understandings of the standards. If groups of students, on average, have not met or nearly met the standards, then teachers may consider the types of learning events, practice, and opportunities available for students to. If g5es av5/Span ⱪS

The following chart lists the icons used to show the relative performance of students on the target versus the whole test.

Guiding Questions to Analyze Group-Level Data [11]

- What is the trend for this group of students related to being “on track” for college readiness? (Overall scores)
- What is the range of overall performance for my class or other groups of students? (Overall scores)
- Which claims appear to be areas of strength for my students? (Claim Achievement Levels)
- Which claims might be areas of need? (Claim Achievement Levels)
- Which targets show a variance from the whole test performance? (Assessment Target Report)
- Which curriculum resources might help me address student needs for the coming year? (Curriculum Resources)
- How do I find examples of student work that meet the goals for being “on track” for college readiness? (Practice Test Scoring Guides)
- What evidence do I need during classroom instruction to know that my students are making progress toward meeting the learning goals for each claim? (Evidence Statements from Item Specifications)
- Where might I find examples of evidence to meet the learning expectations for each claim? (Item Specifications and Practice Test Scoring Guides)
- How can I help my students gain familiarity with the types of questions that they will encounter on the Smarter Balanced Summative Assessments? (Item Specifications: See Appropriate Stems for Writing Items for a Target, Practice Test)
- How might I use the Smarter Balanced resources (Item Specifications, Achievement Level Descriptors, etc.) to increase my students’ awareness of performance expectations?

15 Planning Curriculum for My Students Using Smarter Balanced Score Reports and Resources (2015), located on the Smarter Balanced Digital Library Web page at https://www.smarterbalancedlibrary.org/content/planning-curriculum-my-students-using-smarter-balanced-score-reports-and-resources.

Formative Assessment Process

Teaching includes the formative assessment process with rigorous tasks. Lessons with formative assessments clarify the student learning goals and success criteria and elicit evidence of student understanding. As teachers interpret this evidence, instruction may be adjusted to optimize learning. Learning is accomplished when students demonstrate and apply the knowledge and skills of the standards. Students take an active role in their learning by using rubrics for self-assessment and peer assessment. Students collaborate with teachers to plan next steps to move up the learning progression and apply what they know to new situations to solve real-world problems.

Using the formative assessment process in conjunction with the Smarter Balanced resources, tools, and results, can maximize the use of assessments and assessment data in the teaching and learning cycle.

Below are additional Smarter Balanced resources that can support and enhance teaching