

Target Sampling Mathematics Grade 11						
Claim	Content Category	Assessment Targets	DOK	Items		Total Items
				CAT	PT	
1. Concepts and Procedures	Priority Cluster	D. Interpret the structure of expressions. A-SSE.A (1 & 2)	1, 2	2	0	19-22
		E. Write expressions in equivalent forms to solve problems. A-SSE.B (3 & 4)	1, 2			
		F. Perform arithmetic operations on polynomials. A-APR.A (1)	2			
		G. Create equations that describe numbers or relationships. A-CED.A (1 - 4)	1, 2	4-5		
		H. Understand solving equations as a process of reasoning and explain the reasoning. A-REI.A (1 & 2)	1, 2			
		I. Solve equations and inequalities in one variable. A-REI.B (3 & 4)	1, 2			
		J. Represent and solve equations and inequalities graphically. A-REI.D (10 - 12)	1, 2			
		K. Understand the concept of a function and use function notation. F-IF.A (1 - 3)	1, 2	2		
		L. Interpret functions that arise in applications in terms of a context. F-IF.B (4 - 6)	1, 2			
		M. Analyze functions using different representations. F-IF.C (7 - -)	1, 2, 3			
	N. Build a function that models a relationship between two quantities. F-BF.A (1 & 2)	2	3-4			
	O. Define trigonometric ratios and solve problems involving right triangles. G-SRT.C (6 - 8)	1, 2				
	Supporting Cluster	P. Summarize, represent, and interpret data on a single count or measurement variable. S-ID.A (1 - 2)	1-2	1		
		A. Extend the properties of exponents to rational exponents. N-RN.A (1 & 2)	1, 2			
		B. Use properties of rational and irrational numbers. N-RN.B (3)	1, 2			
C. Reason quantitatively and use units to solve problems. N-Q.A (1 - 3)		1, 2				
		1				

- DOK: Depth of Knowledge, consistent with the Smarter Balanced Content Specifications.
- The CAT algorithm will be configured to ensure the following:
 - For Claim 1, each student will receive at least 7 CAT items at DOK 2 or higher.
 - For Claim 3, each student will receive at least 2 CAT items at DOK 3 or higher.
 - For combined Claims 2 and 4, each student will receive at least 2 CAT items at DOK 3 or higher.

Target Sampling Mathematics Grade 11						
Claim	Content Category	Assessment Targets	DOK	Items		Total Items
				CAT	PT	
2. Problem Solving 4. Modeling and Data Analysis	Problem Solving (drawn across content domains)	A. Apply mathematics to solve well-posed problems arising in everyday life, society, and the workplace. SMP 4	2, 3	2	1–2	8-10
		B. Select and use appropriate tools strategically. SMP 5 C. Interpret results in the context of a situation. SMP 4 D. Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas). SMP 1 & 4	1, 2, 3	1		
	Modeling and Data Analysis (drawn across content domains)	A. Apply mathematics to solve problems arising in everyday life, society, and the workplace. SMP 2 & 4 D. Interpret results in the context of a situation. SMP 1 & 4	2, 3	1	1–3	
		B. Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. SMP 3 E. Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. SMP 4	2, 3, 4	1		
		C. State logical assumptions being used. SMP 3 F. Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas). SMP 4	1, 2, 3	1		
		G. Identify, analyze, and synthesize relevant external resources to pose or solve problems. SMP 3, 4		0		
3. Communicating Reasoning	Communicating Reasoning (drawn across content domains)	A. Test propositions or conjectures with specific examples. SMP 3 D. Use the technique of breaking an argument into cases. SMP 3	2, 3	3	0-2	8-10
		B. Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. SMP 3 E. Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is. SMP 3	2, 3, 4	3		
		C. State logical assumptions being used. SMP 3 F. Base arguments on concrete referents such as objects, drawings, diagrams, and actions. SMP 3 G. At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) SMP 3	2, 3	2		

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Content from CCSSM Widely Applicable as Prerequisites for a Range of College Majors, Postsecondary Programs and Careers*

This table¹ lists clusters and standards with relatively wide applicability across a range of postsecondary work. Table 1 is a **subset** of the material students must study to be college and career ready (CCSSM, pp. 57, 84). Curricular materials, instruction, and assessment must give especially careful treatment to the domains, clusters, and standards in Table 1, including their interconnections and their applications—amounting to a majority of students’ time.

Number and Quantity	Algebra	Functions	Geometry	Statistics and Probability	Applying Key Takeaways from Grades 6–8**
<p>N-RN, Real Numbers: Both clusters in this domain contain widely applicable prerequisites.</p> <p>N-Q*, Quantities: Every standard in this domain is a widely applicable prerequisite. Note, this domain is especially important in the high school content standards overall as a widely applicable prerequisite.</p>	<p>Every domain in this category contains widely applicable prerequisites.^o</p> <p>Note, the A-SSE domain is especially important in the high school content standards overall as a widely applicable prerequisite.</p>	<p>F-IF, Interpreting Functions: Every cluster in this domain contains widely applicable prerequisites.^o</p> <p>Additionally, standards F-BF.1 and F-LE.1 are relatively important within this category as widely applicable prerequisites.</p>	<p>The following standards and clusters are relatively important within this category as widely applicable prerequisites:</p> <p>G-CO.1 G-CO.9 G-CO.10 G-SRT.B G-SRT.C</p> <p>Note, the above standards in turn have learning prerequisites within the Geometry category, including: G-CO.A G-CO.B G-SRT.A</p>	<p>The following standards are relatively important within this category as widely applicable prerequisites:</p> <p>S-ID.2 S-ID.7 S-IC.1</p> <p>Note, the above standards in turn have learning prerequisites within 6-8.SP.</p>	<p>Solving problems at a level of sophistication appropriate to high school by:</p> <ul style="list-style-type: none"> • Applying ratios and proportional relationships. • Applying percentages and unit conversions, e.g., in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m³, acre-feet, etc.). • Applying basic function concepts, e.g., by interpreting the features of a graph in the context of an applied problem. • Applying concepts and skills of geometric measurement e.g., when analyzing a diagram or schematic. • Applying concepts and skills of basic statistics and probability (see 6-8.SP). • Performing rational number arithmetic fluently.

A note about the codes: Letter codes (A, B, C) are used to denote cluster headings. For example, G-SRT.B refers to the *second* cluster heading in the domain G-SRT, “Prove theorems using similarity” (pp. 77 of CCSSM).

* Informed by postsecondary survey data in Conley *et al.* (2011), “Reaching the Goal: The Applicability and Importance of the Common Core State Standards to College and Career Readiness,”

<http://www.epiconline.org/publications/documents/ReachingtheGoal-FullReport.pdf>.

** See CCSSM, p. 84: “...some of the highest priority content for college and career readiness comes from Grades 6-8. This body of material includes powerfully useful proficiencies such as applying ratio reasoning in real-world and mathematical problems, computing fluently with positive and negative fractions and decimals, and solving real-world and mathematical problems involving angle measure, area, surface area, and volume.”

* Modeling star (present in CCSSM)

^o Only the standards without a (+) sign are being cited here.

¹ This table is excerpted from the *High School Publishers Criteria for the Common Core State Standards for Mathematics*.

and skill necessary for a student to be proclaimed “Proficient” will be established through the development of Achievement Level Descriptors and during the setting of performance standards on the assessments.

Claims for Mathematics Summative Assessment

Overall Claim for Grades 3-8	“Students can demonstrate progress toward college and career readiness in mathematics.”
Overall Claim for Grade 11	“Students can demonstrate college and career readiness in mathematics.”
Claim #1	Concepts & Procedures “Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.”
Claim #2	Problem Solving “Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.”
Claim #3	Communicating Reasoning “Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.”
Claim #4	Modeling and Data Analysis “Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.”

Grade 11 SUMMATIVE ASSESSMENT TARGETS

Providing Evidence Supporting Claim #1

Claim #1: Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Content for this claim may be drawn from any of the high school clusters represented below, with a much greater proportion drawn from clusters designated “m” (major) and the remainder drawn from clusters designated “a/s” (additional/supporting) – with these items fleshing out the major work of the grade. Sampling of Claim #1 assessment targets will be determined by balancing the content assessed with items and tasks for Claims #2, #3, and #4. Detailed information about how each Claim 1 assessment target is measured can be found in the Item Specifications “Mathematics High School” zip folder available at <http://www.smarterbalanced.org/smarter-balanced-assessments/>.

Number and Quantity (9-12.N)

Target A [a/s]: Extend the properties of exponents to rational exponents. (DOK 1, 2)

Target B [a/s]: Use properties of rational and irrational numbers. (DOK 1, 2)

Target C [m]: Reason quantitatively and use units to solve problems. (DOK 1, 2)

Algebra (9-12.A)

Target D [m]: Interpret the structure of expressions. (DOK 1)

Target E [m]: Write expressions in equivalent forms to solve problems. (DOK 1, 2)

Target F [a/s]: Perform arithmetic operations on polynomials. (DOK 1)

Target G [a/s]: Create equations that describe numbers or relationships. (DOK 1, 2)

Target H [m]: Understand solving equations as a process of reasoning and explain the reasoning. (DOK 1, 2)

Target I [m]: Solve equations and inequalities in one variable. (DOK 1, 2)

Target J [m]: Represent and solve equations and inequalities graphically. (DOK 1, 2)

Functions (9-12.F)

Target K [m]: Understand the concept of a function and use function notation. (DOK 1)

Target L [m]: Interpret functions that arise in applications in terms of a context. (DOK 1, 2)

Target M [m]: Analyze functions using different representations. (DOK 1, 2, 3)

Target N [m]: Build a function that models a relationship between two quantities. (DOK 1, 2)

Geometry (9-12.G)

Target O: Define trigonometric ratios and solve problems involving right triangles (DOK 1, 2)

Statistics and Probability (9-12.SP)

Target P [m]: Summarize, represent and interpret data on a single count or measurement variable. (DOK 2)

Notes on Grades 9-12 Content Clusters Not Identified as Assessment Targets for Claim 1

Assessment Targets for Claim #2

Claim #2 is aligned to the mathematical practices from the MCCSS. For this reason, the Assessment Targets are all *acts of problem solving* that are consistent across grades and also evolve across grades. Consistent with the above discussion, these acts of problem solving are also tied to content (CCSSM, p. 8).

SUMMATIVE ASSESSMENT TARGETS Providing Evidence Supporting Claim #2
Claim #2: Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.
<p>To preserve the focus and coherence of the standards as a whole, tasks must draw clearly on knowledge and skills that are articulated in the content standards. At each grade level, the content standards offer natural and productive settings for generating evidence for Claim #2. These connections are specified below.</p> <p>Tasks generating evidence for Claim #2 in a given grade will draw upon knowledge and skills articulated in the progression of standards up through that grade, though more complex problem-solving tasks may draw upon knowledge and skills from lower grade levels.</p> <p>Any given task will provide evidence for several of the following assessment targets. Each of the following targets should not lead to a separate task: it is in <i>using</i> content from different areas, including work studied in earlier grades, that students demonstrate their problem-solving proficiency.</p> <p>Content clusters and domains recommended for the majority of Claim 2 item development are given below. Tasks can center on a single cluster or standard listed, or synthesize across listed clusters or standards.</p>

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	HS
3.OA.A	4.OA.A	5.NBT.B	6.RP.A	7.RP.A	8.EE.B	N-Q.A
3.OA.D	4.NBT.B	5.NF.A	6.NS.A	7.NS.A	8.EE.C	A-SSE.A
3.NBT.A*	4.NF.A	5.NF.B	6.NS.C	7.EE.A	8.F.A	A-SSE.B
3.MD.A	4.NF.B	5.MD.A*	6.EE.A	7.EE.B	8.F.B*	A-CED.A
3.MD.B*	4.NF.C	5.MD.C	6.EE.B	7.G.A*	8.G.A	A-REI.2
3.MD.C	4.MD.A*	5.G.A*	6.EE.C	7.G.B*	8.G.B	A-REI.B
3.MD.D*	4.MD.C*		6.G.A*		8.G.C*	A-REI.C
						A-REI.D
						F-IF.A
						F-IF.B
						F-IF.C
						F-BF.A
						G-SRT.C
						S-ID.C
						S-CP.A

* Denotes additional and supporting clusters

SUMMATIVE ASSESSMENT TARGETS

Providing Evidence Supporting Claim #3

Claim #3: Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

and skills that are articulated in the content standards. At each grade level, the content standards offer natural and productive settings for generating evidence for Claim #3. Tasks generating evidence for Claim #3 in a given grade will draw upon knowledge and skills articulated in the standards in that same grade, with strong emphasis on the major work of the grade.

Any given task will provide evidence for several of the following assessment targets; each of the following targets should not lead to a separate task.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School	
3.OA.B	4.OA.3	5.NBT.2	6.RP.A	7.RP.2	8.EE.1	N-RN.A	G-CO.A
3.NF.A	4.NBT.A	5.NBT.6	6.RP.3	7.NS.A	8.EE.5	N-RN.B	G-CO.B
3.NF.1	4.NBT.5	5.NBT.7	6.NS.A	7.NS.1	8.EE.6	N-RN.3	G-CO.C
3.NF.2	4.NBT.6	5.NF.1	6.NS.1	7.NS.2	8.EE.7a	A-SSE.2	G-CO.9
3.NF.3	4.NF.A	5.NF.2	6.NS.C	7.EE.1	8.EE.7b	A-APR.1	G-CO.10
3.MD.A	4.NF.1	5.NF.B	6.NS.5	7.EE.2	8.EE.8a	A-APR.B	G-CO.11
3.MD.7	4.NF.2	5.NF.3	6.NS.6		8.F.1	A-APR.4	G.SRT.A
	4.NF.3a	5.NF.4	6.NS.7		8.F.2	A-APR.6	G.SRT.B
	4.NF.3b	5.NF.7a	6.EE.A		8.F.3	A-REI.A	F-TF.1
	4.NF.3c	5.NF.7b	6.EE.3		8.G.1	A-REI.1	F-TF.2
	4.NF.4a	5.MD.C	6.EE.4		8.G.2	A-REI.2	F-TF.8
	4.NF.4b	5.MD.5a	6.EE.B		8.G.4	A-REI.C	
	4.NF.C	5.MD.5b	6.EE.6		8.G.5	A-REI.10	
	4.NF.7	5.G.B*	6.EE.9		8.G.6	A-REI.11	
		5.G.4*			8.G.8	F-IF.1	
						F-IF.5	
						F-IF.9	
						F-BF.3	
						F-BF.4a	

*Denotes additional and supporting clusters

SUMMATIVE ASSESSMENT TARGETS

Providing Evidence Supporting Claim #4

Claim #4 - Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

To preserve the focus and coherence of the standards as a whole, tasks must draw clearly on knowledge and skills that are articulated in the content standards. At each grade level, the content standards offer natural and productive settings for generating evidence for Claim #4. Tasks generating evidence for Claim #4 in a given grade will draw upon knowledge and skills articulated in the progression of standards up to that grade.

Content clusters and domains recommended for the majority of Claim 4 item development are given below. Tasks can center on a single cluster or standard listed, or synthesize across listed clusters or standards.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	HS
3.OA.A	4.OA.A	5.NBT.B	6.RP.A	7.RP.A	8.EE.3	N-Q.A
3.OA.D	4.NF.B	5.NF.A	6.NS.A	7.NS.A	8.EE.4	A-SSE.B
3.MD.A	4.MD.A*	5.NF.B	6.NS.C	7.EE.B	8.EE.B	A-CED.A
3.MD.C	4.MD.B*	5.MD.A*	6.EE.B	7.G.A*	8.EE.C	A-REI.A
3.MD.D*	4.MD.C*	5.MD.B*	6.EE.C	7.G.B*	8.F.B*	A-REI.B
		5.MD.C	6.G.A*	7.SP.A*	8.G.B	A-REI.C
		5.G.A*	6.SP.A*	7.SP.B*	8.G.C*	F-IF.B
			6.SP.B*	7.SP.C*	8.SP.A*	F-IF.C
						F-BF.A
						S-ID.A
						S-ID.B
						S-IC.1
						S-IC.B
						F-LE.A
						F-LE.B
						F-TF.5
						G-GMD.3
						G-MG

*Denotes additional and supporting clusters

REMINDER: Claim 4 tasks may also ask students to apply content from prior grades in sophisticated applications.