



# California Subject Examinations for Teachers®

## TEST GUIDE

### MATHEMATICS SUBTEST II

### Subtest Description

This document contains the Mathematics subject matter requirements arranged according to the domains covered by Subtest II of CSET: Mathematics. In parentheses after each named domain is the CTC-assigned domain code from the Mathematics subject matter requirements.

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**Mathematics**  
**Subtest II: Geometry; Probability and Statistics**

**Part I: Content Domains for Subject Matter Understanding and Skill  
in Mathematics**

**GEOMETRY (SMR Domain 3)**

Candidates demonstrate an understanding of the foundations of geometry as outlined in the California Common Core Content Standards for Mathematics (Grade 7, Grade 8, and High School). Candidates demonstrate a depth and breadth of conceptual knowledge to ensure a rigorous view of geometry and its underlying structures. They demonstrate an understanding of axiomatic systems and different forms of logical arguments. Candidates understand, apply, and prove theorems relating to a variety of topics in two- and three-dimensional geometry, including coordinate, synthetic, non-Euclidean, and transformational geometry.

**0001 Plane Euclidean Geometry (SMR 3.1)**

- a. Apply the Parallel Postulate and its implications and justify its equivalents (e.g., the Alternate Interior Angle Theorem, the angle sum of every triangle is 180 degrees)
- b. Demonstrate knowledge of complementary, supplementary, and vertical angles
- c. Prove theorems, justify steps, and solve problems involving similarity and congruence
- d. Apply and justify properties of triangles (e.g., the Exterior Angle Theorem, concurrence theorems, trigonometric ratios, triangle inequality, Law of Sines, Law of Cosines, the Pythagorean Theorem and its converse)
- e. Apply and justify properties of polygons and circles from an advanced standpoint (e.g., derive the area formulas for regular polygons and circles from the area of a triangle)
- f. Identify and justify the classical constructions (e.g., angle bisector, perpendicular bisector, replicating shapes, regular polygons with 3, 4, 5, 6, and 8 sides)

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Geometry, Grade 7 [7.G]; Geometry, Grade 8; Congruence, High School [G-CO]; Similarity, Right Triangles, and Trigonometry, High School [G-SRT]; Circles, High School [G-C]; Geometric Measurement and Dimension, High School [G-GMD])

**0002 Coordinate Geometry (SMR 3.2)**

- a. Use techniques in coordinate geometry to prove geometric theorems
- b. Model and solve mathematical and real-world problems by applying geometric concepts to two-dimensional figures

**MATHEMATICS**  
**SUBTEST II: GEOMETRY; PROBABILITY AND STATISTICS**

- c. Translate between the geometric description and the equation for a conic section
- d. Translate between rectangular and polar coordinates and apply polar coordinates and vectors in the plane

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Geometry, Grade 8; Expressing Geometric Properties with Equations, High School [G-GPE]; Geometric Measurement and Dimension, High School [G-GMD]; Modeling with Geometry, High School [G-MG]; Polar Coordinates and Curves, High School)

**0003 Three-Dimensional Geometry (SMR 3.3)**

- a. Demonstrate knowledge of the relationships between lines and planes in three dimensions (e.g., parallel, perpendicular, skew, coplanar lines)
- b. Apply and justify properties of three-dimensional objects (e.g., the volume and surface area formulas for prisms, pyramids, cones, cylinders, spheres)
- c. Model and solve mathematical and real-world problems by applying geometric concepts to three-dimensional figures

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Congruence, High School [G-CO]; Similarity, Right Triangles, and Trigonometry, High School [G-SRT]; Geometric Measurement and Dimension, High School [G-GMD]; Modeling with Geometry, High School [G-MG])

**0004 Transformational Geometry (SMR 3.4)**

- a. Demonstrate knowledge of isometries in two- and three-dimensional space (e.g., rotation, translation, reflection), including their basic properties in relation to congruence
- b. Demonstrate knowledge of dilations (e.g., similarity transformations or change in scale factor), including their basic properties in relation to similarity, volume, and area

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Geometry, Grade 8; Congruence, High School [G-CO])

**PROBABILITY AND STATISTICS (SMR Domain 4)**

Candidates demonstrate an understanding of statistics and probability distributions as outlined in the California Common Core Content Standards for Mathematics (Grade 7, Grade 8, and High School). Candidates demonstrate a depth and breadth of conceptual knowledge to ensure a rigorous view of probability and statistics and their underlying structures. They solve problems and make inferences using statistics and probability distributions.

**MATHEMATICS**  
**SUBTEST II: GEOMETRY; PROBABILITY AND STATISTICS**

**0005 Probability (SMR 4.1)**

- a. Prove and apply basic principles of permutations and combinations
- b. Illustrate finite probability using a variety of examples and models (e.g., the fundamental counting principles, sample space)
- c. Use and explain the concepts of conditional probability and independence
- d. Compute and interpret the probability of an outcome, including the probabilities of compound events in a uniform probability model
- e. Use normal, binomial, and exponential distributions to solve and interpret probability problems
- f. Calculate expected values and use them to solve problems and evaluate outcomes of decisions

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Statistics and Probability, Grade 7 [7.SP]; Conditional Probability and the Rules of Probability, High School [S-CP]; Using Probability to Make Decisions, High School [S-MD])

**0006 Statistics (SMR 4.2)**

- a. Compute and interpret the mean and median of both discrete and continuous distributions
- b. Compute and interpret quartiles, range, interquartile range, and standard deviation of both discrete and continuous distributions
- c. Select and evaluate sampling methods appropriate to a task (e.g., random, systematic, cluster, convenience sampling) and display the results
- d. Apply the method of least squares to linear regression
- e. Apply the chi-square test
- f. Interpret scatter plots for bivariate data to investigate patterns of association between two quantities (e.g., correlation), including the use of linear models
- g. Interpret data on a single count or measurement variable presented in a variety of formats (e.g., dot plots, histograms, box plots)
- h. Demonstrate knowledge of P-values and hypothesis testing
- i. Demonstrate knowledge of confidence intervals

(California Common Core Content Standards for Mathematics, including Standards for Mathematical Practice 1–8: Statistics and Probability, Grade 8; Interpreting Categorical and Quantitative Data, High School [S-ID])

**MATHEMATICS**  
**SUBTEST II: GEOMETRY; PROBABILITY AND STATISTICS**

**Part II: Subject Matter Skills and Abilities**  
**Applicable to the Content Domains in Mathematics**

Candidates for Single Subject Teaching Credentials in mathematics use inductive and deductive reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason both abstractly and quantitatively, they use counterexamples, construct proofs using contradictions, construct viable arguments, and critique the reasoning of others. They create multiple representations of the same concept. They know the interconnections among mathematical ideas, use appropriate tools strategically, and apply techniques and concepts from different domains and sub-domains to model the same problem. They explain mathematical interconnections with other disciplines. They are able to communicate their mathematical thinking clearly and coherently to others, orally, graphically, and in writing. They attend to precision, including the use of precise language and symbols.

Candidates make sense of routine and complex problems, solving them by selecting from a variety of strategies. They look for and make use of structure while demonstrating persistence and reflection in their approaches. They analyze problems through pattern recognition, look for and express regularity in repeated reasoning, and use analogies. They formulate and prove conjectures, and test conclusions for reasonableness and accuracy. They use counterexamples to disprove conjectures.

Candidates select and use different representational systems (e.g., coordinates, graphs). They understand the usefulness of transformations and symmetry to help analyze and simplify problems. They model with mathematics to analyze mathematical structures in real contexts. They use spatial reasoning to model and solve problems that cross disciplines.

(California Common Core Content Standards for Mathematics [Grade 7, Grade 8, and High School], including Standards for Mathematical Practice 1–8)