Progression to Higher Mathematics

The progression from kindergarten standards to standards for higher mathematics, beginning with Mathematics I or Algebra I, exemplifies the three principles of focus, coherence, and rigor that are central to the CA CCSSM.

In kindergarten through grade five (K–5), the focus is on addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals, with a balance of concepts, skills, and problem solving. Arithmetic is viewed as an important set of skills and also as a thinking subject that prepares students for higher mathematics. Measurement and geometry develop alongside number and operations and are tied specifically to arithmetic along the way.

In middle school, multiplication and division develop into the powerful forms of ratio and proportional reasoning. The properties of operations take on prominence as arithmetic matures into algebra. The theme of quantitative relationships also becomes explicit in grades six through eight, developing into the formal concept of a function by grade eight. Meanwhile, the foundations of deductive geometry are laid in the middle grades. Finally, the gradual development of data representations in kindergarten through grade five leads to statistics in middle school: the study of shape, center, and spread of data distributions; possible associations between two variables; and the use of sampling in making statistical decisions.

In higher mathematics, algebra, functions, geometry, and statistics develop with an emphasis on modeling. Students continue to take a thinking approach to algebra, learning to see and make use of structure in algebraic expressions of growing complexity (Partnership for Assessment of Readiness for College and Careers [PARCC] 2012).

Mathematics is a logically progressing discipline that has intricate connections among the various domains and clusters in the standards. Sustained practice is required to master grade-level and course-level content. The major work (or emphases) in the standards for kindergarten through grade eight is noted in the Cluster-Level Emphases charts presented in each of the grade-level chapters that follow. Further, table OV-1 (adapted from Achieve the Core 2012) summarizes an important subset of the major work in kindergarten through grade eight, as the progression of learning in the standards leads toward Mathematics I or Algebra I.

Table OV-1. Progression to Algebra I and Mathematics I in Kindergarten Through Grade Eight

Kindergarten	Grade One	Grade Two	Grade Three	Grade Four	Grade Five	Grade Six	Grade Seven	Grade Eight
Know number names and the count sequence Count to tell the number of objects Compare numbers Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from Work with numbers 11–19 to gain foundations for place value	Represent and solve problems involving addition and subtraction Understand and apply properties of operations and the relationship between addition and subtraction Add and subtract within 20 Work with addition and subtraction equations Extend the counting sequence Understand place value Use place-value understanding and properties of operations to add and subtract Measure lengths indirectly and by iterating length units	Represent and solve problems involving addition and subtraction Add and subtract within 20 Understand place value Use place-value understanding and properties of operations to add and subtract Measure and estimate lengths in standard units Relate addition and subtraction to length	Represent and solve problems involving multiplication and division Understand properties of multiplication and the relationship between multiplication and division Multiply and divide within 100 Solve problems involving the four operations, and identify and explain patterns in arithmetic Develop understanding of fractions as numbers Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects Geometric measurement: understand concepts of area, and relate area to multiplication and to addition	Use the four operations with whole numbers to solve problems Generalize place-value understanding for multi-digit whole numbers Use place-value understanding and properties of operations to perform multi-digit arithmetic Extend understanding of fraction equivalence and ordering Build fractions from unit fractions by applying and extending previous understandings of operations Understand decimal notation for fractions, and compare decimal fractions	Understand the place-value system Perform operations with multi-digit whole numbers and decimals to hundredths Use equivalent fractions as a strategy to add and subtract fractions Apply and extend previous understandings of multiplication and division to multiply and divide fractions Geometric measurement: understand concepts of volume, and relate volume to multiplication and to addition Graph points in the coordinate plane to solve real-world and mathematical problems*	Apply and extend previous understandings of multiplication and division to divide fractions by fractions Apply and extend previous understandings of numbers to the system of rational numbers Understand ratio concepts and use ratio reasoning to solve problems Apply and extend previous understandings of arithmetic to algebraic expressions Reason about and solve one-variable equations and inequalities Represent and analyze quantitative relationships between dependent and independent variables	Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers Analyze proportional relationships and use them to solve real-world and mathematical problems Use properties of operations to generate equivalent expressions Solve real-life and mathematical problems using numerical and algebraic expressions and equations	Work with radicals and integer exponents Understand the connections between proportional relationships, lines, and linear equations Analyze and solve linear equations and pairs of simultaneous linear equations Define, evaluate, and compare functions Use functions to model relationships between quantities

Adapted from Achieve the Core 2012.

*Indicates a cluster that is well thought of as part of a student's progress to algebra, but that is currently not designated as Major by one or both of the assessment consortia (PARCC and Smarter Balanced) in their draft materials. Apart from the one exception marked by an asterisk, the clusters listed here are a subset of those designated as Major in both of the assessment consortia's draft documents.