A Look at…

Fourth Grade

in California Public Schools

Including information about the new
Common Core State Standards

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Mathematics

Overview

Effective mathematics education provides students with a balanced instructional program. In such a program, students become proficient in basic computational skills and procedures, develop conceptual understandings, and become adept at problem solving. Standards-based mathematics instruction starts with basic material and increases in scope and content as the years progress. It is like an inverted pyramid, with the entire weight of the developing subject, including readiness for algebra, resting on the foundations built in the early grades.

California recently adopted new standards in mathematics, the Common Core State Standards (CCSS) with California additions. The CCSS are comprised of standards developed by the state-led Common Core State Standards Initiative and material taken from the 1997 California mathematics standards. California will implement these new standards gradually over the next several years as curriculum frameworks, instructional materials, and assessments based on the CCSS are adopted.

There are many similarities between the CCSS and the 1997 California mathematics standards, but there are also a few noteworthy differences. For instance, the CCSS are organized by "domains" which add grade-level focus and vary slightly by grade. The domains for grade four are Operations and Algebraic Thinking (OA), Number and Operations in Base Ten (NBT), Number and Operations—Fractions (NF), Measurement and Data (MD), and Geometry (G). Also, the CCSS do not include "key standards" as in the 1997 California mathematics standards. Instead the CCSS are designed to have a greater focus at each grade and to develop mathematics topics in depth. In the early grades, the CCSS continue to emphasize concepts necessary for the study of more advanced mathematics in later years. To ensure that students have adequate time to achieve mastery, some of the 1997 California mathematics standards familiar to California's fourth grade teachers will be taught in different grades after the CCSS are fully implemented.

This section provides an overview of the new CCSS for fourth grade mathematics, including some highlights of how the fourth grade curriculum, based on the 1997 California mathematics standards, change with the implementation of the new CCSS. It includes a review of some mathematical concepts and skills from third grade (prerequisite skills) and guidance on areas of mathematics that may be challenging for some English learners. A complete listing of the grade four CCSS with California additions for mathematics can be found at the end of this section. A complete listing of the grade four 1997 California mathematics standards is located on the CDE Web page at http://www.cde.ca.gov/be/st/ss/documents/mathstandard.pdf.

What Fourth Grade Students Should Know

Students entering fourth grade who have met the third grade CCSS understand place value (amounts of thousands) and can round whole numbers to the nearest 10 or 100. They know from memory all products of numbers from 1 to 9 and can fluently multiply and divide (within 100) and add and subtract (within 1000). They can utilize the four operations of addition, subtraction, multiplication and division to solve word problems.

By the start of fourth grade, students recognize fractions as numbers. They can use a number line to represent, explain and compare various positive fractions (e.g., unit fractions, equivalent fractions, whole numbers as fractions and fractions with the same numerator or the same denominator). Students know how to

apply their understanding of fractions to measure lengths using rulers marked with halves and fourths of an inch. They can also relate their understanding of fractions and geometry to partition shapes into parts with equal areas and represent each part as a unit fraction of the whole.

Entering fourth grade students understand how to measure liquid volume (using standard units) and the area of plane figures (by counting unit squares). They can relate the concept of area to the operations of multiplication and division and understand that the area of a rectangle can be found by multiplying the side lengths. Students know how to compare common geometric shapes (e.g., rectangles and quadrilaterals) based on common attributes (e.g., having four sides).

What Students Learn in Fourth Grade

Fourth grade students perform multi-digit arithmetic. They use large whole numbers to fluently add and subtract and to develop fluency with multiplication and division (including quotients with remainders). They develop an understanding of fraction equivalence, addition and subtraction of fractions (with like denominators) and multiplication of fractions by whole numbers. Students classify geometric shapes based on properties (i.e., parallel or perpendicular sides, angle measurements and symmetry).

Operations and Algebraic Thinking

In both the grade four 1997 California mathematics standards and the CCSS, students use the four operations (addition, subtraction, multiplication and division) with whole numbers to solve problems. Students solve multistep word problems, including problems in which remainders must be interpreted, and a rounded solution is appropriate. As fourth grade students solve problems that mix the four arithmetic operators, they use the convention of order of operations to solve problems (first multiply and divide from left to right, and then add and subtract from left to right). With full implementation of the CCSS, the use of parentheses to modify the order of operations will be introduced at grade five (a grade four topic in the 1997 California standards).

Students solve multistep word problems, including problems in which remainders must be interpreted, and a rounded solution is appropriate.

In fourth grade, students find all factor pairs for whole numbers in the range 1–100. They determine whether a given whole number is a multiple of a one-digit number or is a prime number. These factoring skills are important as fourth grade students generate equivalent fractions.

With full implementation of the CCSS, fourth graders will generate a number or shape pattern that follows a given rule. This concept is similar to work with linear patterns at grade three in the 1997 California standards. Also, negative numbers will be introduced at grade 6, a grade four topic in the 1997 California standards.

Number and Operations in Base Ten

In both the 1997 California mathematics standards and the CCSS, fourth grade students extend their place value understanding to include multi-digit whole numbers. Students read, write, and compare numbers based on the meaning of the digits in each place (a digit in one place represents ten times what it represents in the place to its right). Students also use place value understanding to round multi-digit whole numbers. At grade four, the CCSS limit place value understanding to whole numbers less than or equal to 1,000,000, while the 1997 California standards include whole numbers in the millions.

In fourth grade, students perform multi-digit arithmetic with whole numbers. They fluently add and subtract multi-digit numbers. They multiply (multi-digit numbers by two-digit numbers) and divide (four-digit numbers by a one-digit number), including quotients with remainders. They can explain their understanding of multiplication and division calculations by using equations, rectangular arrays, and/or area models.

With full implementation of the CCSS, some third grade concepts in the 1997 California standards will be covered at fourth grade. For example, addition and subtraction (with two whole numbers within 1,000–10,000), multiplication and division (whole numbers with up to four digits by one-digit numbers), and rounding numbers to the nearest thousands.

Number and Operations—Fractions

Student proficiency with fractions is essential to success in algebra at later grades. In fourth grade, the 1997 California mathematics standards focus on fractional concepts. For example, students explain different interpretations of fractions (including equivalent fractions) and write a fraction represented by a drawing. The CCSS extend this conceptual work with fractions as students recognize and generate equivalent fractions, and compare two fractions with different numerators and different denominators (e.g., by creating common denominators).

Student proficiency with fractions is essential to success in algebra at later grades.

With full implementation of the CCSS, various fractional concepts will be covered at different grades. For example, a few concepts in the grade five 1997 California standards will be addressed at grade four when students add and subtract mixed numbers with like denominators, and they apply the meaning of multiplication to multiply a fraction by a whole number and solve related word problems. Similarly, a grade three concept in the 1997 California standards will be covered at grade four as students add and subtract simple fractions, with like denominators.

Both the 1997 California mathematics standards and the CCSS develop an understanding of decimal fractions and decimal notations. Fourth grade students use their understanding of equivalent fractions to order and compare decimals. They use the decimal notation for fractions with denominators 10 or 100 (e.g., rewrite 0.62 as 62/100), and compare two decimals to hundredths using a number line or another visual model to justify conclusions. Students also add two fractions with denominators 10 and 100 (*e.g., 3/10 + 4/100 = 34/100).*

With full implementation of the CCSS, some related grade four topics in the 1997 California standards will be covered at grade five as students add, subtract and round decimals.

Measurement and Data

Both the 1997 California mathematics standards and the CCSS develop measurement and unit conversion skills. Fourth grade students understand relative sizes of measurement units within one system of units (such as ounce, liter, and milliliter or hour, minute and second) and express measurements in a larger unit in terms of a smaller unit (for example, 1 foot. is 12 inches). Students solve word problems involving measurement and they apply the area and perimeter formulas for rectangles in real world and mathematical problems.

In fourth grade, students recognize angles as geometric shapes. They measure angles and solve addition and subtraction problems to find unknown angles on a diagram.

With full implementation of the CCSS, several grade four topics in the 1997 California standards will be addressed at different grade levels. For example, graphing points on a two-dimensional coordinate grid will be covered at grade five; work with statistical survey questions and measures of center for data sets (i.e., median) will move to grade six; and outcomes of probability will be covered at grade seven.

Geometry

The 1997 California mathematics standards and the CCSS focus on how to classify shapes. Students classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines and angles and identify special triangles (e.g., right, equilateral, isosceles, scalene) and special quadrilaterals (e.g., rhombus, square, rectangle, parallelogram, trapezoid). Fourth grade students also recognize a line of symmetry for a two-dimensional figure, identify line-symmetric figures and draw lines of symmetry.

With full implementation of the CCSS, some geometry concepts at grade four in the 1997 California standards will be addressed at different grade levels. For example, radius and diameter of a circle will be covered at grade six and congruent figures will be a topic in grade eight and Algebra I.

Support for English Learners

Students need to develop knowledge of mathematics as a language. However, the academic language of mathematics instruction and the specialized vocabulary of mathematics can create particular challenges for English learners.

The specialized vocabulary of mathematics should be explicitly taught and reinforced throughout the year.

The language of mathematics is very precise compared with the English used in common discourse. English learners need opportunities to develop their knowledge of the features of language that are used to teach mathematics, such as semantics (how to translate the words of a problem into a symbolic representation), syntax (the order of words and phrases), and mathematical discourse (writing or talking about mathematical terms, concepts, etc.). The specialized vocabulary of mathematics should be explicitly taught and reinforced throughout the year.

These areas can create special challenges for English learners in the early grades:

- At an early stage students may have difficulty with such English words as first, second, last, before, every, each, more, and equal. Students may be unfamiliar with sum, difference, solve, length, and value.
- The different meanings of multiple-meaning words should be explicitly taught. These words may have a meaning in common discourse that is different from the meaning in mathematics, such as table or face (as in the face of a clock).
- The place values of some of the numbers between 10 and 20 are not obvious from their names (e.g., the number 16 is called sixteen in English, but ten plus six in other languages).
- The narrative descriptions of a word problem can require language skills that students have not yet mastered, particularly when the language of a word problem is ambiguous or includes idioms (e.g., “a dime a dozen”), comparatives (greater than, less than, most often, least often), or position words (behind, below, in front of, to the right or left of).

Instruction in mathematics should be promoted despite low literacy or limited proficiency in the English language, along with critical thinking and analysis skills. Specially designed academic instruction in English (SDAIE) strategies can provide valuable instructional strategies to meet the needs of English learners. For additional resources to support the teaching of English learners, go to the CDE English Learners Web page at http://www.cde.ca.gov/sp/el/.

Use of Calculators

Although not discussed in the CCSS, the use of calculators plays a special role in mathematics teaching and learning. Initially, it is important that students in the early grades develop a facility with basic arithmetic skills without reliance on calculators. At later grades, once students are ready to use calculators to their advantage, calculators can provide a very useful tool not only for solving problems in various contexts but also for broadening students' mathematical horizons.

The Standards

The CCSS that follow are the pre-publication version of the standards prepared by the Sacramento County Office of Education (SCOE), updated on October 21, 2010. Content that is unique to California and was added to the multi-state common core standards is in bold typeface. The SCOE document is available online at http://www.scoe.net/castandards/agenda/2010/math_ccs_recommendations.pdf (Outside Source). These grade four CCSS for Mathematics were adopted by the California State Board of Education on August 2, 2010.

A complete listing of the grade four 1997 California mathematics standards is located on the CDE Web page at http://www.cde.ca.gov/be/st/ss/documents/mathstandard.pdf.

Common Core State Standards with California Additions Mathematics – Grade Four	
Operations and Algebraic Thinking (4.OA)	
Use the four operations with whole numbers to solve problems.	
1.	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
2.	Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.[1]
3.	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding **and explain why a rounded solution is appropriate.**
Gain familiarity with factors and multiples.	
4.	Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a

[1] See Glossary, Table 2

	multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
Generate and analyze patterns.	
5.	Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.*
Number and Operations in Base Ten (4.NBT)[2]	
Generalize place value understanding for multi-digit whole numbers.	
1.	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.*
2.	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
3.	Use place value understanding to round multi-digit whole numbers to any place.
Use place value understanding and properties of operations to perform multi-digit arithmetic.	
4.	Fluently add and subtract multi-digit whole numbers using the standard algorithm.
5.	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5.1	**Solve problems involving multiplication of multi-digit numbers by two-digit numbers. (CA Standard NS 3.3)**
6.	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Number and Operations—Fractions (4.NF)[3]	
Extend understanding of fraction equivalence and ordering.	
1.	Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions

[2] Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.
[3] Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

	themselves are the same size. Use this principle to recognize and generate equivalent fractions.
2.	Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.	
3.	Understand a fraction a/b with $a > 1$ as a sum of fractions $1/b$. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8; 3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.
4.	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. a. Understand a fraction a/b as a multiple of $1/b$. *For example, use a visual fraction model to represent 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4).* b. Understand a multiple of a/b as a multiple of $1/b$, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 × (2/5) as 6 × (1/5), recognizing this product as 6/5. (In general, n × (a/b) = (n × a)/b.)* c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*
Understand decimal notation for fractions, and compare decimal fractions.	

5.	Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.[4] *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.*
6.	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*
7.	Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using **the number line or another** visual model.
Measurement and Data (4.MD)	
Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	
1.	Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*
2.	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
3.	Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*
Represent and interpret data.	
4.	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.*
Geometric measurement: understand concepts of angle and measure angles.	
5.	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two

[4] Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.

	rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.
6.	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
7.	Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.
Geometry (4.G)	
Draw and identify lines and angles, and classify shapes by properties of their lines and angles.	
1.	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
2.	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. **(Two dimensional shapes should include special triangles, e.g., equilateral, isosceles, scalene, and special quadrilaterals, e.g., rhombus, square, rectangle, parallelogram, trapezoid.)**
3.	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.
	Standards for Mathematical Practice Integrated throughout the CCSS 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

CCSS Domains

The CCSS are organized by domains. The table lists the domains for grades kindergarten through grade eight. The table identifies which domains are addressed in kindergarten through grade five (an "X" indicates the domain addressed at a grade level). The shaded rows indicate domains to be covered at later grades.

Domains	Kindergarten	Grade One	Grade Two	Grade Three	Grade Four	Grade Five
Counting and Cardinality (CC)	X					
Operations and Algebraic Thinking (OA)	X	X	X	X	X	X
Number and Operations in Base Ten (NBT)	X	X	X	X	X	X
Measurement and Data (MD)	X	X	X	X	X	X
Geometry (G)	X	X	X	X	X	X
Number and Operations – Fractions (NF)				X	X	X
Ratios and Proportional Relationships (RP)						
The Number System (NS)						
Expressions and Equations (EE)						
Statistics and Probability (SP)						
Functions (F)						