

California Adopts New Common Core Standards

by Paul Giganti, Jr., CMC Math Festival Program
pgiganti@berkeley.edu



Something HUGE has recently happened in California in K–12 education and, for a change, there is good news! California recently adopted new curriculum standards in mathematics and language arts from Kindergarten through high school—the first changes made to the California standards in more than 12 years. Over the summer 2010, the State Board of Education adopted what are called the Common Core Standards, which represent a national agreement on what K–12 students should know and learn in our schools. As the implementation of the new California Common Core Standards (CaCCSS) gradually happens over the next three years, parents will hear more about them, especially in terms of how they will affect their children’s grade level curriculum, instruction, and state testing.

When you look at the Standards for individual grade levels, you will see many similarities, and some notable differences. However, what may change the most in California’s classrooms is HOW mathematics is taught and what students will be expected to learn beyond basic skills. These changes, which are referred to as Mathematical Practices in the new California Common Core Standards in mathematics, are probably the biggest change, and the subject of this article.

The Standards for Mathematical Practice describe the types of mathematical knowledge and capabilities all students should learn. These practices reflect the most current thinking on what students need to be proficient, or good mathematics students.

1. Students need to make sense of, and persevere in solving problems.

Good mathematics students know that before they can begin solving a problem they must first thoroughly understand the problem and understand which strategies might work best in finding a solution. They not only consider all the facts given in the problem, but also form an idea

of the solution—perhaps an estimation or approximation—and make a plan, rather than simply jumping in without much thought. They first consider similar and related problems to gain insights. Older students might use algebraic equations or technology. Younger students might use concrete objects, drawings, or diagrams to help them “see” the problem. Good mathematics students check their progress along the way, change course if necessary, and continually ask themselves, “Does this make sense?” Even after finding a solution, good mathematics students try hard to understand how other students solved the same problem in different ways.

2. Students need to reason abstractly and quantitatively.

Good mathematics students make sense of the numbers and their relationships in problems. They are able to represent a given situation with symbols and operations AND relate the mathematics of the problem to real life situations. They consider the units of measure involved, the size and meaning of the numbers involved, and the context of the problem and its solution. In this way, good mathematics students make sense of a problem and apply that understanding to consider if their answer makes sense.

3. Students need to construct arguments and critique the reasoning of others.

Good mathematics students understand and use assumptions, definitions, and previously learned information in helping them build solutions. They make conjectures and apply logical thinking to explore and test their ideas. They analyze problems by breaking them down into smaller parts, and look for counterexamples. They are able to explain their results to others and answer the questions and objections of others. They analyze all available data and information carefully. Young students can explain and demonstrate their solutions by

using concrete objects, drawings, and diagrams. Older students can construct intuitive or deductive proofs of their theories, either in writing, verbally, or by other means.

4. Students need to be able to model with mathematics.

Good mathematics students apply the mathematics they know to solve problems in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a real situation involving money. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how changing one variable affects the result. Good mathematics students routinely interpret their mathematical results in the context of the situation and think about whether their results make sense.

5. Students need to use appropriate tools strategically.

Good mathematics students consider all the mathematics tools at their disposal before beginning a problem. Tools might include pencil and paper, manipulatives, models and diagrams, a ruler, a protractor, a calculator, a spreadsheet, a graphing calculator, a computer statistical package, and/or dynamic geometry software, to mention just a few. Students are familiar with, and know how to appropriately use, mathematics tools for their grade and choose wisely the best tools to use for a particular problem. For example, older students should be able to analyze graphs of functions by using a graphing calculator; younger students should be able to use blocks to model a multiplication problem. Students should be able to search out and wisely use mathematical resources such as the library, knowledgeable individuals, and the Internet.

6. Students need to attend to precision.

Good mathematics students learn to communicate clearly and completely to others using correct mathematical language and logical arguments. They calculate accurately and efficiently and express numerical answers with the precision required by the problem. In their discussion and presentations, good mathematics students can explain and defend their choice of

symbols, operations, and processes to convince other students and adults they are correct.

7. Students need to be able to look for and make use of structure.

Good mathematics students discover and carefully observe pattern, logical order, and structure in mathematics. Young students, for example, might discover that all even numbers end in 0, 2, 4, 6, or 8, while older students discover that in the ordered pairs (1, 3), (2, 5), (3, 7), (4, 9), the second number in the pair is always one more than twice the first number. Good mathematics students can also step back to view the whole, but still pay careful attention to the individual facts and numbers in a problem. Good mathematics students should be able to imagine the graph of a function, such as $y = 2x + 1$, before they graph it, because they understand what each element— y , $=$, 2 , x , $+$, and 1 —does in the algebraic generalization.

8. Students need to look for and express regularity in repeated reasoning.

Good mathematics students know when to apply tried-and-true methods in solving a problem, and when it is most useful to apply a new approach or shortcut. For example, when middle school students convert a fraction into a decimal, they should notice when they are repeating the same calculations over and over again, and then conclude that they have a repeating decimal. Younger students should notice that when multiplying 11 by any number up to 9 they can simply double that digit to get the answer. While working to solve a problem, good mathematics students not only understand basic mathematics methods and correctly apply those methods, but also watch for novel ways to solve similar problems in more efficient ways.

Depending on how strongly our policy makers, textbook publishers, test makers, and educators understand and reinforce these Common Core Standards for Mathematical Practices, there may be dramatic changes ahead in mathematics education for your children. Watch for more information about the California Common Core Standards. 📖

Permission is granted to reproduce and share this article for instructional use by parents, guardians, teachers, and families—provided it is duplicated with full credit given to the author, the California Mathematics Council, and its Journal, the ComMuniCator.