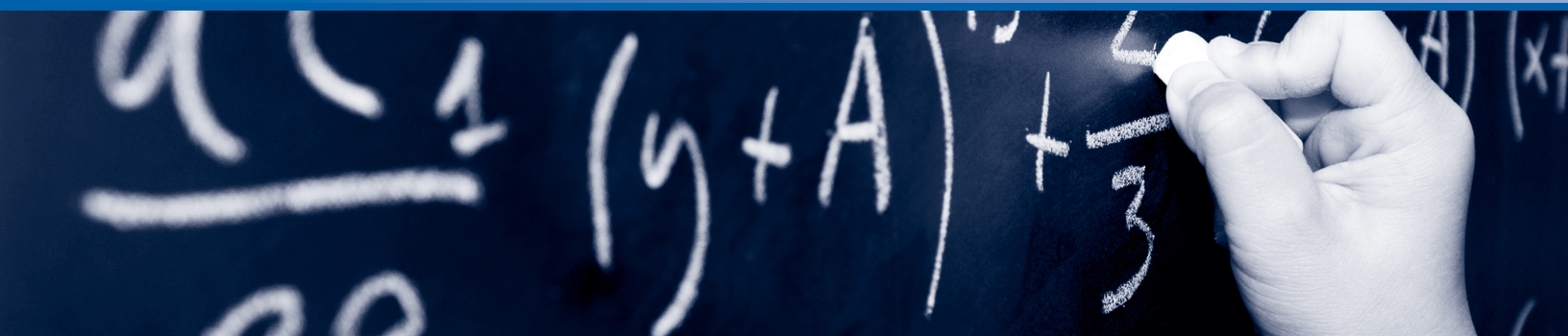




High Standards + Support = More Students Taking Tougher Math



WHEN CALIFORNIA ADOPTED ITS NEW mathematics standards at the turn of this century, it set high goals for its K–12 students, including encouraging them to take Algebra I in eighth grade. As a further incentive, beginning with the class of 2004, students must pass Algebra I to graduate from high school. Questions on Algebra I are also included on the California High School Exit Exam, which students must pass to receive their diplomas.

In addition, the state's two public university systems—University of California (UC) and California State University (CSU)—require a minimum of three years of high school math: typically Algebra I, geometry, and Algebra II. For many high school students, one of the biggest hurdles to college admission is the math requirement.

This brief looks at how the state's high school students are meeting these math challenges within the context of California's standards-based reforms. It focuses on access to and proficiency in Algebra I as the state's minimum requirement for high school graduates and on Algebra II as the minimum expectation for admission to a four-year public university.

When considering math course taking, the gatekeepers are Algebra I and Algebra II

The state adopted the mathematics standards in 1997, but it was not until 2001–02 that California fully adopted K–8 texts and provided some funds for instructional materials. About the same time, the state supported the creation of professional

development programs to train math teachers in how to impart the new content standards. In 2000, California also changed the high school graduation requirement so that, beginning with the class of 2004, all students had to pass Algebra I.

Since 2003, enrollment in higher-level math classes has increased

After state support to implement the standards began and the new graduation requirement became law, more high school students started enrolling in higher-level math courses, with strong growth from 2003 through 2006. At the same time, fewer eighth and ninth graders were taking the general mathematics course, which focuses on sixth and seventh grade standards. The more limited data that are available indicate

a similar pattern between 2002 and 2003. (The course-taking data are derived from California Standards Test results. See the box below.)

Figure 1a on page 2 shows the percent of students taking math courses in eighth through 11th grade over time. In 2003, four out of five of the state's eighth through 11th grade students were taking math, as follows:

- Less than half (43%) were taking Algebra I or geometry;
- Almost twice as many (24%) were taking general mathematics as were taking Algebra II or higher (13%).

Four years later, in 2006, almost nine out of 10 students in those four grades were taking a math class, as follows:

- More than half (55%) were taking either Algebra I or geometry;

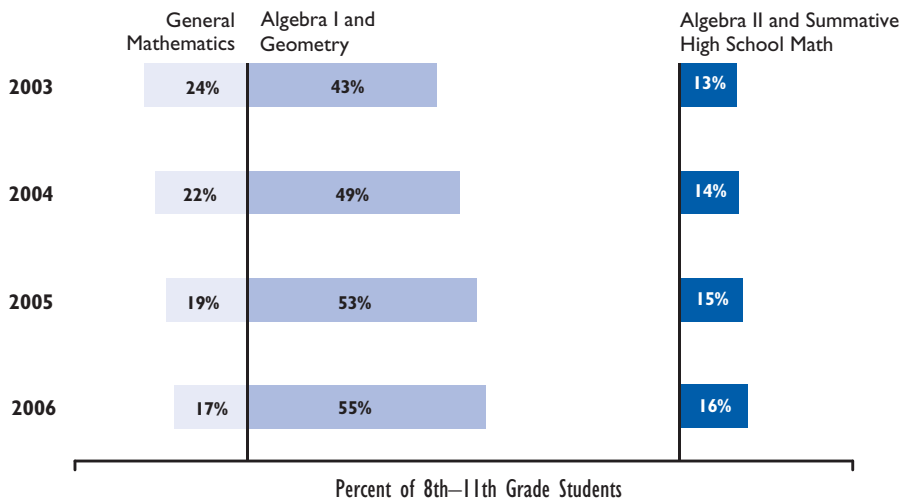
Course-taking data used in this brief are based on California Standards Test (CST) results

Course-taking data used in this brief are based on end-of-course California Standards Test (CST) results from eighth through 11th grade. (Students in 12th grade do not take CSTs.)

It is important to note that students take the Summative High School Math CST during the school year after they have completed Algebra II even if they are not enrolled in a math class. Therefore, the method used in this brief could lead to an overestimate of the percentage of students *taking courses* in higher-level math. Further, students in ninth and 10th grades who completed Algebra II in a previous year take the summative math test each year through 11th grade. However, this may have little impact on the data because these students are the state's top math students and are likely to be taking higher-level math courses at their high school or a community college. In 2006, slightly more than 3% of students completed Algebra II before 10th grade.

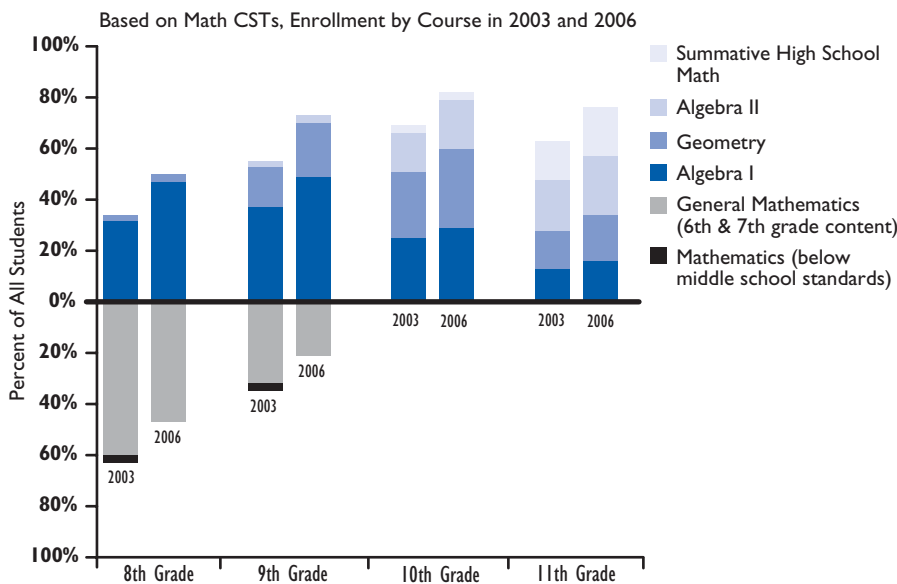
In addition, the method used in this brief likely undercounts the number of eighth graders enrolled in Algebra I because some districts offer a two-year Algebra I course (eighth and ninth grades). State guidelines specify that students in those two-year courses are to take the General Mathematics CST—not the Algebra I CST—in eighth grade.

figure 1a | More students are taking the gatekeeper courses*—Algebra I and Algebra II



Note: Totals in Figure 1a include a small percentage of students (close to 2% in 2003 and less than 1% in 2006) who took Integrated Math courses.

figure 1b | More students are taking Algebra I and higher-level math classes* earlier in their school careers, with the largest increase in the percent of eighth and ninth graders taking Algebra I and a smaller increase in the percent of 10th and 11th graders taking Algebra II



Note: As shown in Figure 1b, in 2003, 3% of eighth graders and 3% of ninth graders took a mathematics standards test that was below middle school standards. In 2006, only nine eighth graders took that CST.

* These percentages are based on using CSTs as proxies for course taking. It is important to note that students take the Summative High School Math CST the school year after they have completed Algebra II even if they are *not enrolled* in a higher-level math course. So the percentage of students taking courses higher than Algebra II may be an overestimate. In addition, some eighth grade students who took the General Mathematics CST may have been enrolled in a two-year (eighth and ninth grades) Algebra I course, thus undercounting the number of students enrolled in Algebra I and overcounting the number enrolled in General Mathematics.

DATA: CALIFORNIA DEPARTMENT OF EDUCATION (CDE)

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- Almost as many students were taking Algebra II or higher (16%) as were taking general math (17%).

(The percentages above include a small number of students in those four grades—close to 2% in 2003 and less than 1% in 2006—who took one of the three Integrated Math courses, which cover Algebra I, geometry, and Algebra II concepts and have their own CSTs.)

When reported by grade level, the biggest increase in test taking is in Algebra I (eighth and ninth grades)

The state's most successful math students are completing Algebra I in eighth grade, moving on to geometry in ninth grade, and enrolling in Algebra II in 10th. Some continue their pursuit of higher-level math as juniors and seniors, studying trigonometry, linear algebra, mathematical analysis, calculus, and advanced probability and statistics.

The bar charts in Figure 1b show math course taking by grade level from 2003 to 2006:

- The largest increase—15 percentage points—was in the percent of students taking Algebra I in eighth grade (32% in 2003 compared to 47% in 2006).
- The growth in Algebra I test taking in ninth grade was almost as large—12 percentage points—(37% in 2003 compared with 49% in 2006).
- In 2006, a relatively high percentage of students also took Algebra I in 10th (29%) and 11th (16%) grades, but the relative percentage point increase from 2003 is considerably smaller.

As Figure 1b shows, the percentage of students in grades 8–11 taking geometry, Algebra II, and higher-level math courses also increased during that time period, and the percentage of students taking general math (sixth and seventh grade standards) and mathematics (below middle school standards) dropped.

As students progress through high school, they are less likely to take math

Almost all eighth graders in 2006 were taking a math class—from general mathematics to Algebra II—that had an end-of-course CST. However, as Figure 2 shows, by 10th grade, the percent of students taking any math course measured by a CST (including the Integrated

Math courses) decreased to 82%, with a further drop to 77% in 11th grade. This same pattern was more pronounced in 2003. That year, only 71% of 10th graders and 67% of 11th graders were enrolled in a math class measured by a CST.

It is interesting to note that 18% of 10th graders did not take one of these math tests in 2006 even though they must take two years of math—including Algebra I—in high school to meet state graduation requirements. (Many districts require more math classes.) However, some high schools might offer math courses that do not have a CST.

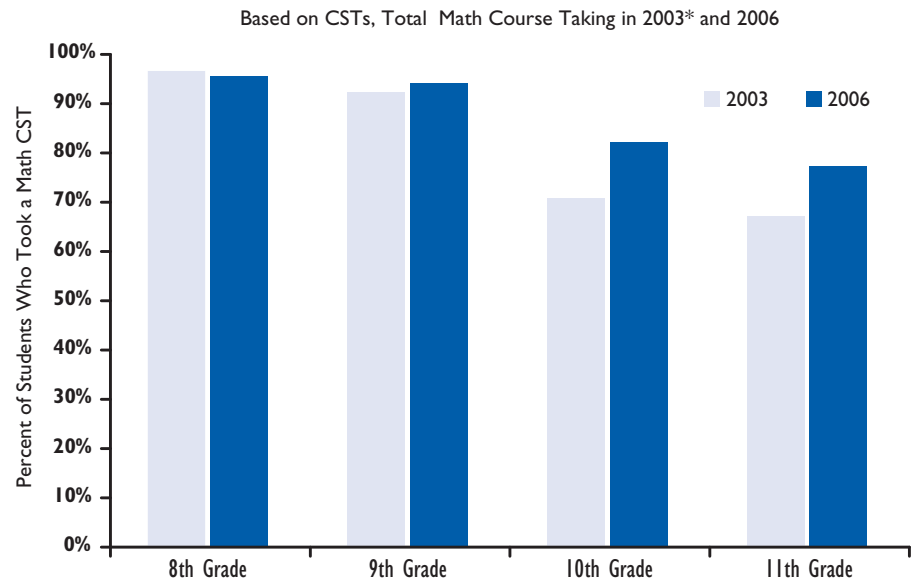
Most students do not score proficient on end-of-course tests

Simply taking a course—or even earning an “A” or “B”—does not necessarily mean that a student has mastered the subject. Test results are expressed as far below basic, below basic, basic, proficient, and advanced. The state’s goal is for all students to score proficient or advanced.

Nearly half of eighth graders in 2006 took Algebra I, and 40% of those *test-takers* scored proficient or advanced on the California Standards Test at the end of the course. The available data also make it possible to determine the percent of *all* eighth graders who have scored proficient or advanced on the Algebra I CST. As indicated by the line in Figure 3, about 19% of California’s eighth graders in 2006 scored proficient or above on the Algebra I CST before entering high school. (In addition, between 2% and 3% of eighth graders scored proficient or advanced in geometry or Algebra II.) This 19% represents an improvement over earlier years. In 2003, only about 12% of California’s eighth graders scored proficient or advanced on the Algebra I CST.

The state encourages California’s students to enroll in Algebra I by eighth grade and wants all high school students to take Algebra I by ninth grade. Generally, those who enroll in Algebra I in ninth grade have been less successful in math in middle school. So it is not surprising that of the 49% of ninth graders in 2006 who *took* Algebra I, only 19% showed they were proficient on the CST.

figure 2 As students progress through high school, fewer take math; but over time, more students have continued their mathematical studies into their sophomore and junior years



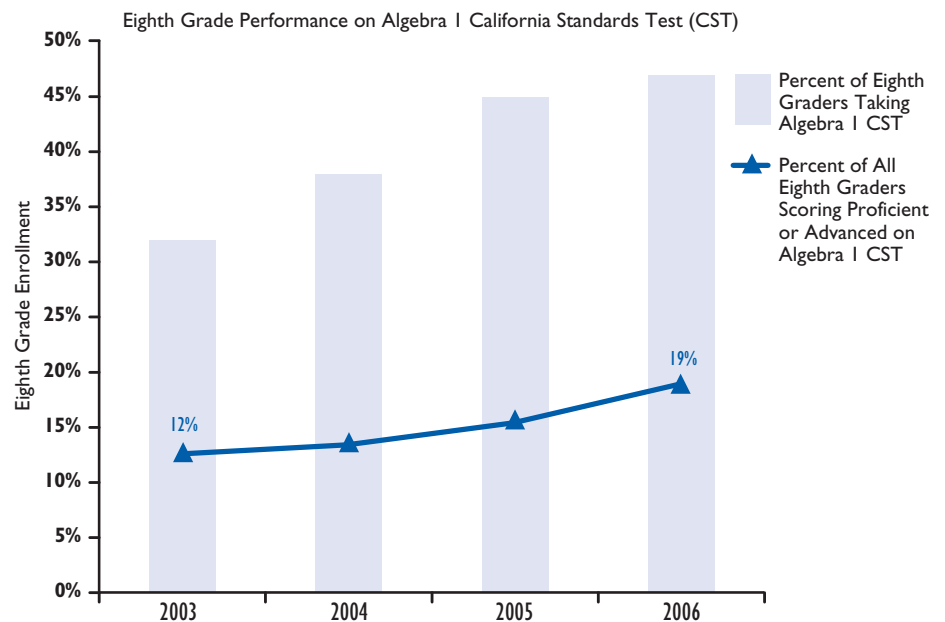
* This includes 3% of eighth graders and 3% of ninth graders in 2003 who took a math CST below middle school standards.

Note: The course-taking percentages in this figure are based on how many students take specific standards-based tests. However, students take the Summative High School Math CST during the school year after they completed Algebra II even if they are *not enrolled* in a higher-level math course. So the percentage of students taking math courses may be an overestimate.

DATA: CALIFORNIA DEPARTMENT OF EDUCATION (CDE)

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figure 3 The percent of all eighth graders scoring proficient or advanced on the Algebra I CST has increased



DATA: CALIFORNIA DEPARTMENT OF EDUCATION (CDE)

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● | To Learn More

For an in-depth description of California's high school curriculum, including math, see EdSource's publication, *Lever for Change: Opportunities to Strengthen California's High School Curriculum* (5/07).

For another look at how California's students are succeeding in math—including information about the state's Latino students—see the 2007 EdSource Forum presentation by John Mockler, president of John Mockler & Associates and former executive director of the State Board of Education. Go to www.edsource.org and click on "Video of the speakers and panel discussion" under 30th annual Forum.

Only a small percentage of students in 2006 scored proficient or advanced in Algebra II, the gateway course to public universities

In 2006, only 2% of all ninth graders, 8% of all 10th graders, and 10% of all 11th graders scored proficient or advanced in either Algebra II or the Summative High School Math CST.

California's four-year public universities have found that many students have not met the universities' minimum requirements for college-level math, which include knowledge of Algebra II. To help students better understand what they need to know, CSU developed an Early Assessment Program (EAP), which offers expanded versions of the Algebra II and summative math CSTs. High school juniors whose schools participate in EAP can choose to take one of these expanded CSTs. The results are used by CSU to exempt students from college placement tests or let students know that they need additional preparation. As an added benefit, EAP also encourages high school students to take these CSTs seriously.

Comparing 2006 EAP results with the CST proficiency levels for that year shows an intriguing contrast. In 2006, 72% of all

What the data do not tell

Because the state does not track the course taking and test results of individual students, it is difficult to measure students' success in math over time.

For example, in spring 2005, 15% of all eighth graders scored proficient or advanced on the California Standards Test (CST) in Algebra I; and in spring 2006, 9% of all ninth graders scored proficient or above on the Algebra I CST. But those percentages cannot be added together to declare that 24% of all ninth graders in the class of 2009 are proficient in Algebra I. One of the reasons that estimate cannot be made is that no one knows if the 15% of eighth graders who scored proficient in 2005 stayed in California's public school system for ninth grade. Some may have moved out of state or entered a private school.

A number of other circumstances can distort course-taking data that rely on CSTs. For example, eighth graders who did not pass Algebra I would likely repeat the course and take the CST again the following year.

Enrollment also is far from static. Enrollment data report 34,000 more ninth graders in 2006 than eighth graders in 2005—an almost 7% increase. This variation from eighth to ninth grade occurs annually but cannot be clearly explained. These ninth graders could have been home-schooled or have attended eighth grade in a private in-state school or a school outside California. If some of them had already taken Algebra I and enrolled in geometry in ninth grade, state testing data would not count them as proficient on the Algebra I CST. The variation might also reflect high school retention policies when students fail classes in ninth grade.

11th graders who were taking Algebra II or a higher-level math course—about 134,000 juniors—took the expanded CSTs. Of those 134,000, close to 74,000 (about 55%) were college-ready, according to EAP program administrators. However, in 2006, only about 46,000 juniors scored proficient or advanced on the Algebra II or Summative High School Math CST. So it appears that a significant number of the almost 50,000 juniors who scored *basic* on one of those two CSTs did well enough on the expanded tests for CSU to consider them prepared for college-level math.

High school students are showing progress in meeting state goals

Data based on math CSTs from 2003 through 2006 show that California's high schools and their students are making progress in meeting

the state's math goals. The threat of not receiving a high school diploma has meant a steady and substantial increase in the number of students taking Algebra I. This emphasis on Algebra I appears to be encouraging more students to also take higher-level math, though the numbers are increasing at a slower pace.

The EAP data seem to show that scoring proficient or advanced—at least in higher-level math courses—is indeed a high standard. How this high standard for high school math proficiency aligns to what state universities expect entering freshmen to know is unclear. It may well be that the majority of students who advance to post-Algebra II math courses—even if they score basic on the Summative High School Math CST—are prepared to enter a four-year public university in California without a math deficit. ■■



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EdSource thanks the **Bill & Melinda Gates Foundation** for its investment in our core work.

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