



Data Science and the High School Math Curriculum

Statement by academic staff at California 4-year colleges and universities

We write to emphasize that for students to be prepared for STEM and other quantitative majors in 4-year colleges, including data science, learning the Algebra II curriculum (see pp. 77-84 [here](#)) in high school is essential. This cannot be replaced with a high school statistics or data science course, due to the cumulative nature of mathematics.

In other words, students who take a data science course as an *alternative* to Algebra II in high school will be **substantially underprepared** for any STEM major in college, **including data science, computer science, statistics, and engineering**. Such students will need remedial math classes in college before they can even begin such majors, putting them at a considerable disadvantage (for summer opportunities and the ability to earn such a degree in 4 years) compared to peers who learn such material in high school. It is crucial that parents, teachers, and policy makers be aware

Data literacy (e.g., spreadsheet skills and very basic statistical ideas) is a valuable life skill that should be acquired in high school. Elements of this can be naturally introduced in science labs and social studies courses, and it can be taken alongside a math class.

It is misleading, however, to promote data literacy and high-school level data science courses as a substitute for learning math content in preparation for college-level quantitative courses. Algebra, statistics, geometry, trigonometry, and calculus as topics in the high school math curriculum **are not interchangeable**.

The surge of interest in data science as a goal of college degrees and careers is reminiscent of the explosion of interest in computer science that began around 2010 and hasn't let up since. In both cases, math is a foundational tool for such work in both academia and industry. The skills and knowledge acquired in high school math have a big impact on preparedness for these areas in college and beyond.

Topics in Algebra II such as logarithms, exponentials, and trigonometry are not relics of the Sputnik era or mere luxuries for future Math and engineering majors. They are foundational across work in quantitative fields including data science, neuroscience, machine learning, statistics, computational biology, and computer graphics.

Algebra II in high school is an essential prerequisite to later learn the further math, such as calculus, needed in much of the coursework for undergraduate data science and statistics majors at campuses of the University of California (UC), the California State University (CSU) system, and private institutions such as Caltech and Stanford University. The devaluing of calculus in the promotion of data science (such as [here](#) and [here](#)) misrepresents its central role in machine learning and data science at large. It also goes against the American Statistical Association's [recommendation](#) that all undergraduate statistics degrees require calculus and linear algebra.

Minimum general college admission requirements, which may not even include Algebra II (let alone more advanced topics), are generally not a reliable guide to the high school preparation needed for many quantitative college majors. The best

college departments and college faculty in these modern community of the core report of high school math necessary for preparedness for 4-year college degrees in quantitative fields is given [here](#); it is a synthesis of input from Stanford University faculty across all STEM fields, with an eye towards preparation at any college.

Claims that mathematical topics related to data science are inherently more engaging or more equitable than other areas of high school math (as is suggested on lines 1226-1239 of Chapter 5 of the [California Math Framework](#)) are incorrect. All areas of high school math are amenable to engagement, equitable practices, and good teaching methods, and can be motivated by modern real-life questions [without sacrificing content](#). The most effective way to diversify the STEM pipeline and to prepare more students for a STEM career is for [more students to learn](#) the core math content in high school.

There is one final reason for the value of algebra and calculus in data science coursework: it provides broader preparation for a decades-long career. We are currently in the midst of a revolution in machine learning, and those who graduated 10 years ago didn't need to know about deep neural networks (which rely on multivariable calculus and linear algebra). But with an education in that mathematics which has been taught to college students for generations, they can keep up with such innovations that are now changing all fields involving data.

No one knows what new ideas will be needed 10 years from now, but the data and AI revolutions of the life sciences and computer science in the past 15 years rest on the same solid foundation in algebra and calculus that has been the language for physical sciences for centuries. These fundamental tools will also remain the bedrock for future developments in data science. Students desiring to earn a 4-year college degree in data science, economics, or any STEM field must prioritize learning Algebra II in high school.





Signatories are limited to academic staff at 4-year colleges and universities in California. To sign the statement, please click [here](#) (or alternatively, go to the "sign the statement" link at the top right corner of this page).

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