

*The Calculus Trap*  
by Richard Rusczyk

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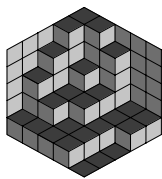
You love math and want to learn more. But you're in ninth grade and you've already taken nearly all the math classes your school offers. They were all pretty easy for you and you're ready for a greater challenge. What now? You'll probably go to the local community college or university and take the next class in the core college curriculum. Chances are, you've just stepped in the calculus trap.

For an avid student with great skill in mathematics, rushing through the standard curriculum is not the best answer. That student who breezed unchallenged through algebra, geometry, and trigonometry, will breeze through calculus, too. This is not to say that high school students should not learn calculus they should. But more importantly, the gifted, interested student should be exposed to mathematics outside the core curriculum, because the standard curriculum is not designed for the top students. This is even, if not especially, true for the core calculus curriculum found at most high schools, community colleges, and universities.

Developing a broader understanding of mathematics and problem solving forms a foundation upon which knowledge of advanced mathematical and scientific concepts can be built. Curricular classes do not prepare students for the leap from the usual 'one step and done' problems to multi-step, multi-discipline problems they will face later on. That transition is smoothed by exposing students to complex problems in simpler areas of study, such as basic number theory or geometry, rather than giving them their first taste of complicated arguments when they're learning a more advanced subject like group theory or the calculus of complex variables. The primary difference is that the curricular education is designed to give students many tools to apply to straightforward specific problems. Rather than learning more and more tools, avid students are better off learning how to take tools they have and apply them to complex problems. Then later, when they learn the more advanced tools of curricular education, applying them to even more complicated problems will come more easily.

Another danger of the calculus trap is social. Aside from the obvious perils of placing a 15 year old in a social environment of 19 year olds, there are other drawbacks to early acceleration. If ever you are by far the best, or the most interested, student in a classroom, then you should find another classroom. Students of like interest and ability feed off of each other. They learn from each other; they challenge and inspire each other. Going from 'top student in my algebra class' to 'top student in my college calculus class' is not a great improvement. Going from 'top student in my algebra class' to 'average student in my city's math club' is a huge step forward in your educational prospects. The student in the math club is going to grow by great leaps, led and encouraged by other students.

In addition to this intellectual enrichment, the social enrichment of being amongst like-minded peers is invaluable. My closest friends now are doctors, bond traders, consultants, lawyers, professors, artists, and so on. Some are religious, some aren't. Some are athletic, some aren't. The common thread among them all is that they all enjoy using their minds. I met nearly all of them through activities or employment that selected for thinkers. In school, these activities were (and still are in most schools) extracurricular programs, not curricular ones. The top athletes don't take PE in school, or even PE in the nearby college. They gather with other top athletes in special programs to enhance their development. The top students can do the same for their minds.



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Many students get stuck in the calculus trap because they believe it's their only option. This is a large part of why we are developing our online community and our online classes. However, we are not the only other option. Other options students have are to become involved in extracurricular programs, such as math teams. (Math contests should be selected with some care; those that encourage mass memorization or just test standard curricular tools tend to exacerbate the ills of the calculus trap rather than enhance problem solving ability.) Students can also pursue independent study if they are able to find mentors. University professors are occasionally willing to fill this role to some degree. There are also many summer programs and good books for extracurricular study, and some communities have developed grassroots programs to provide opportunities for eager students. These options are usually not as easy as 'enroll in the next course,' but they will be far more rewarding than settling into the calculus trap.