

Challenges for Undergraduate Mathematics

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Teaching Undergraduate Mathematics

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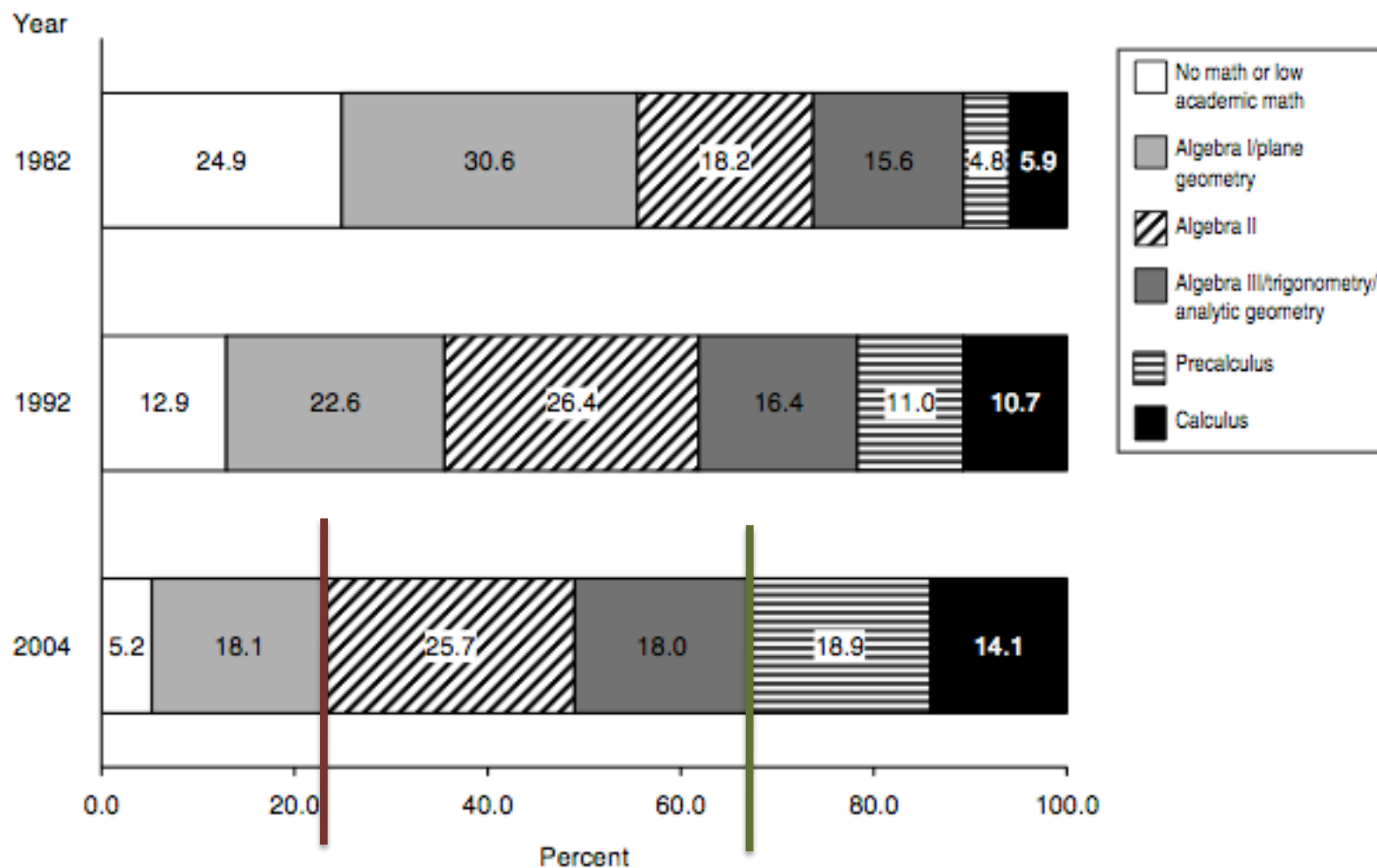
May 11, 2009



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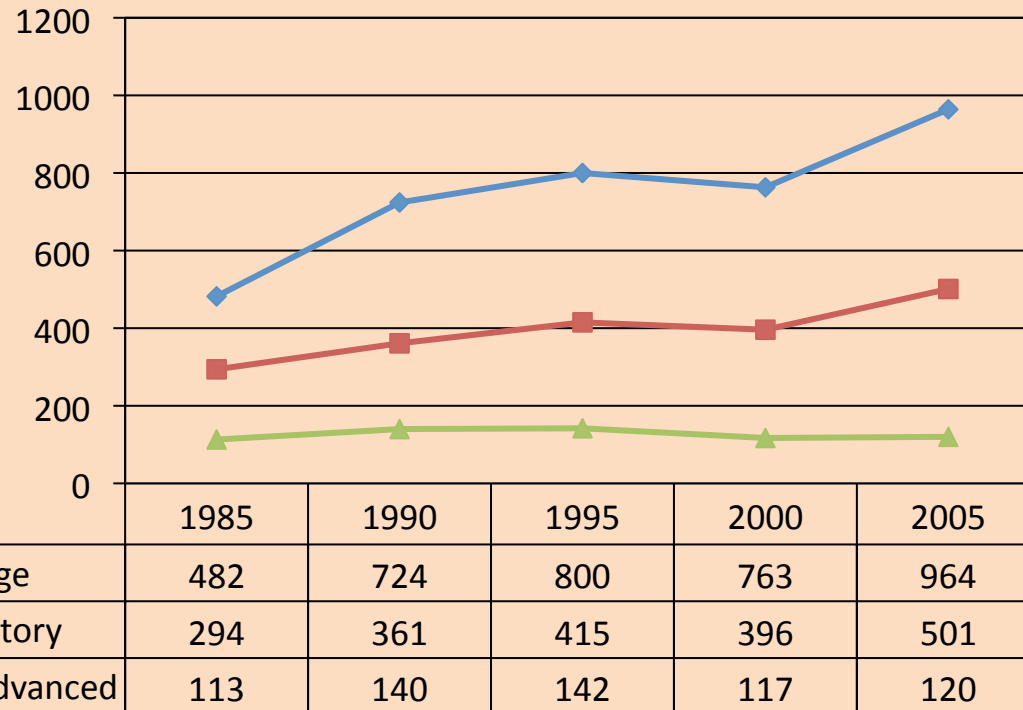
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Figure 1. Percentage of high school graduates who completed different levels of mathematics courses: 1982, 1992, and 2004



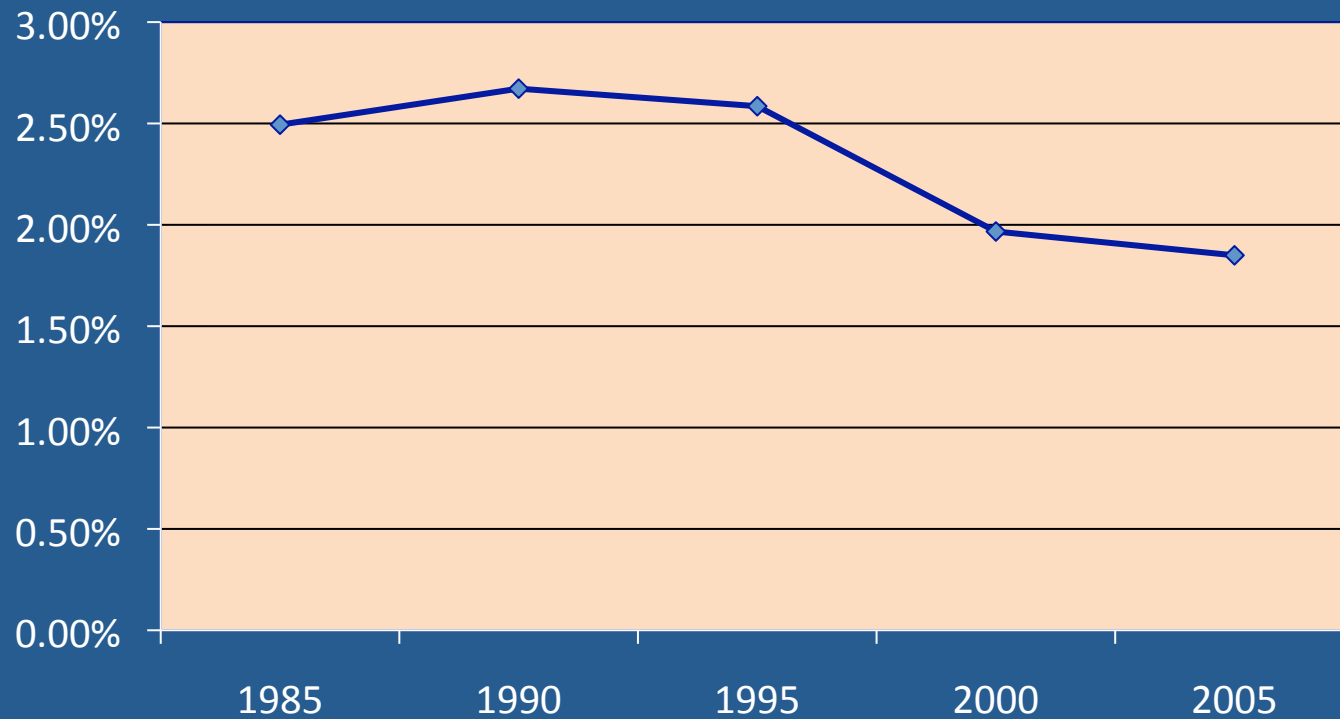
Advanced Mathematics and Science Coursetaking in the Spring High School Senior Classes of 1982, 1992, and 2004. NCES 2007-312

Fall enrollments (thousands) in 2-year undergraduate programs

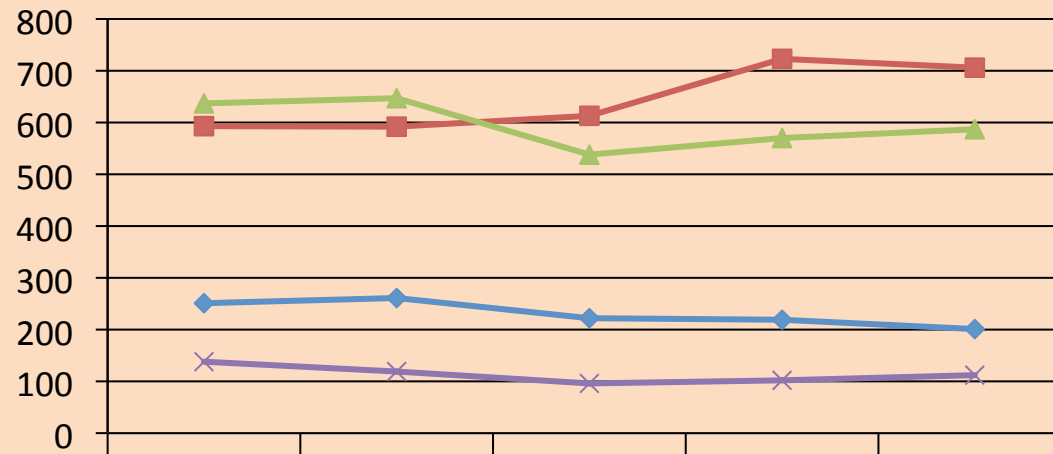


45% increase in 2-year college enrollments during this time

Percentage of students in 2-year undergraduate programs enrolled in mathematics at level of calculus or above



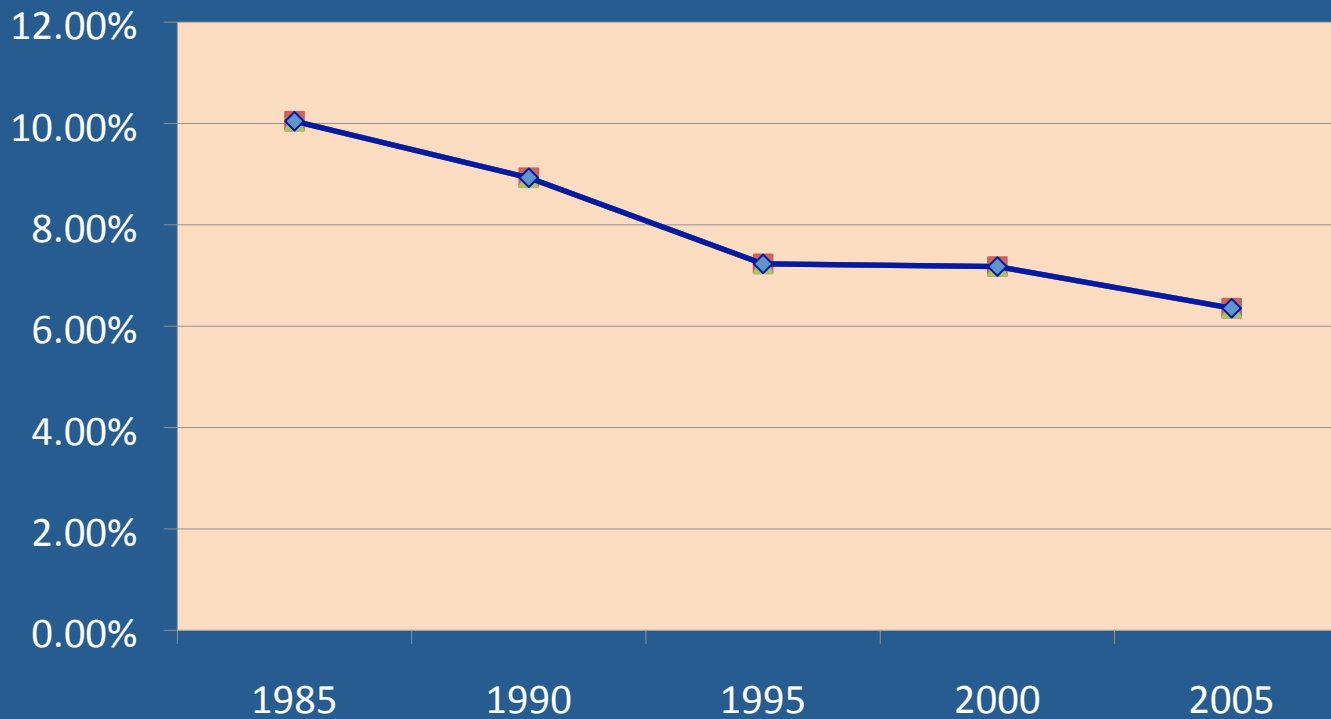
Fall enrollments (thousands) in 4-year undergraduate programs



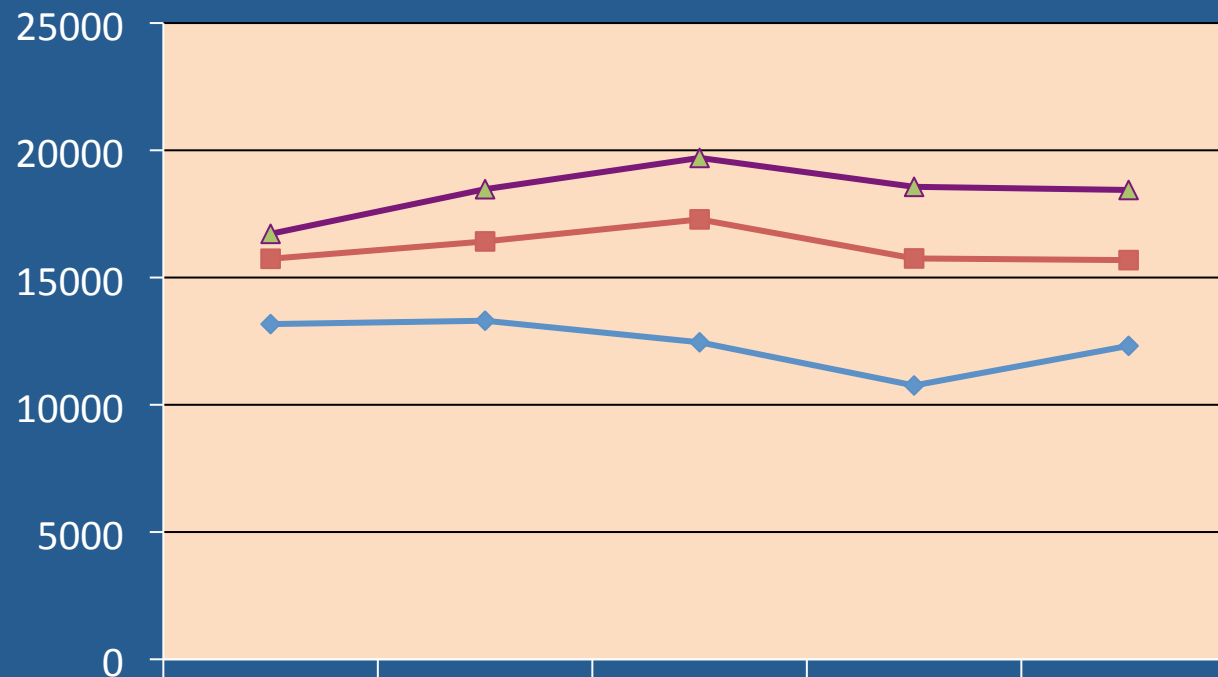
	1985	1990	1995	2000	2005
◆ precollege	251	261	222	219	201
■ introductory	593	592	613	723	706
▲ calculus level	637	647	538	570	587
✕ advanced	138	119	96	102	112

43% increase in 4-year college enrollments during this time

Percentage of students in 4-year undergraduate programs enrolled in mathematics at level of calculus or above



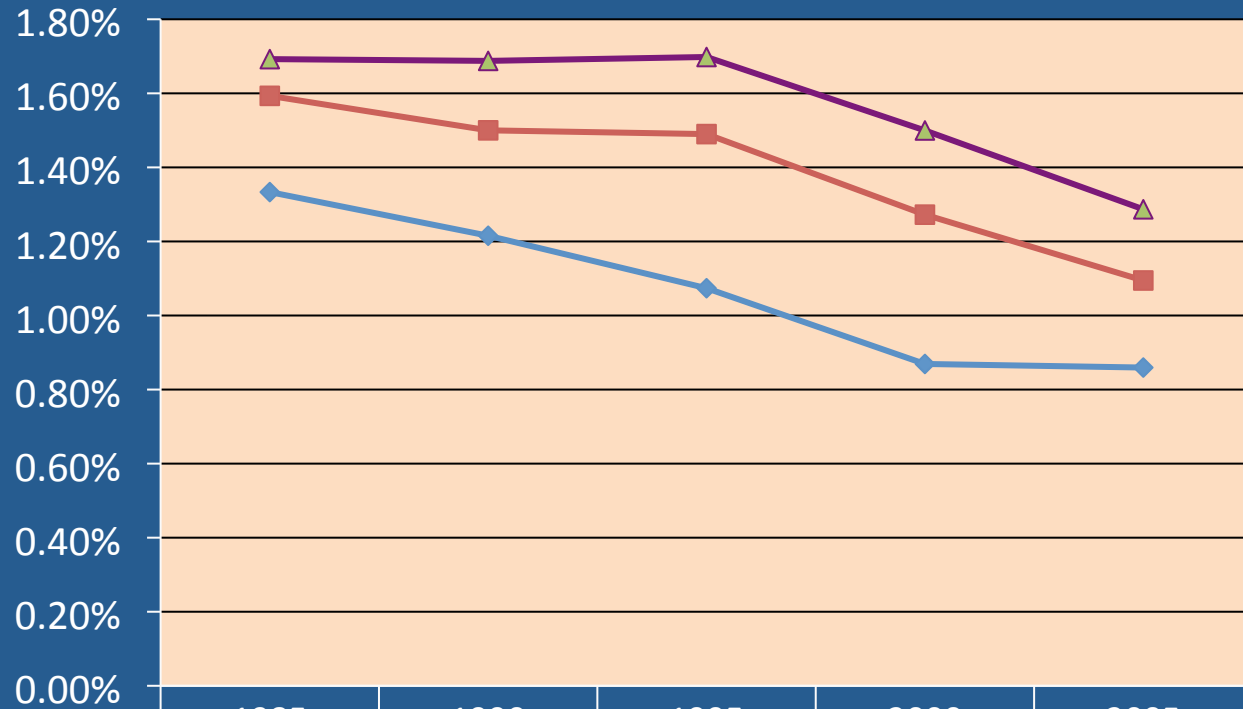
Bachelor's Degrees in Mathematical Sciences



	1985	1990	1995	2000	2005
◆ Math	13171	13303	12456	10759	12316
■ Math + Math Ed	15738	16419	17285	15750	15685
▲ Math Sciences total	16718	18472	19701	18565	18441

CBMS data

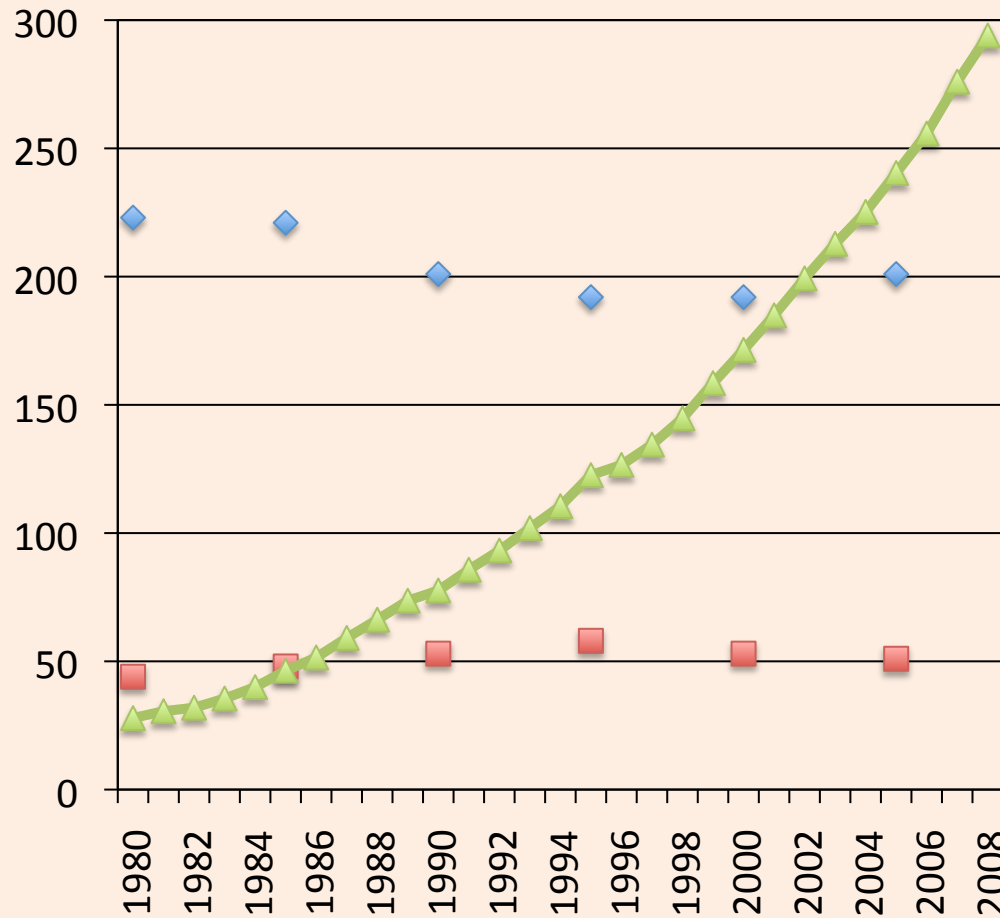
Math Majors as Percent of Total Degrees



	1985	1990	1995	2000	2005
◆ Math	1.33%	1.22%	1.07%	0.87%	0.86%
■ Math + Math Ed	1.59%	1.50%	1.49%	1.27%	1.09%
▲ Math Sciences total	1.69%	1.69%	1.70%	1.50%	1.29%

CBMS data

Fall Enrollments in Calculus I versus AP Calculus Exams (thousands)



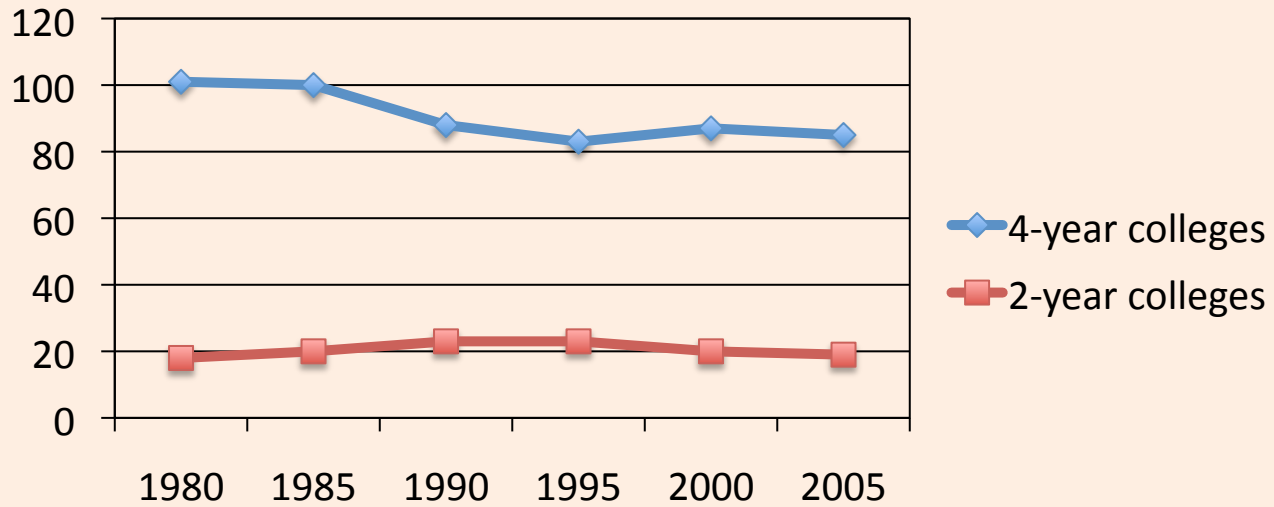
500,000–600,000 students study calculus in high school each year.
160,000–200,000 earn college credit for this course.

- ◆ 4-year colleges
- 2-year colleges
- ▲ AP exams (AB & BC)

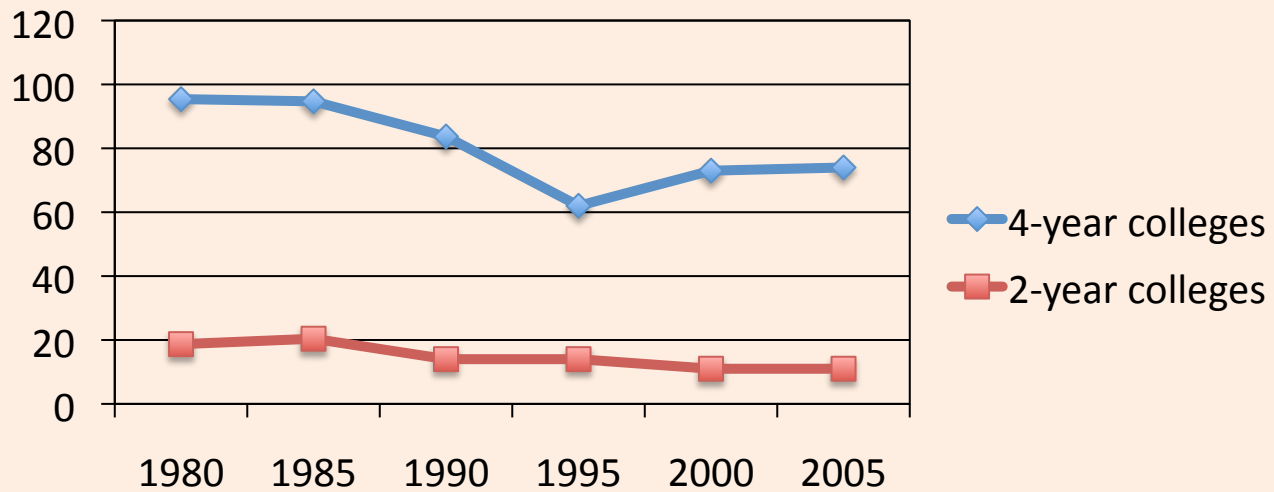
Of the high school students who graduated in 1992 and studied “calculus” while in high school, 31% took *precalculus* in college, and another 32% took *no calculus* in college.

From the transcript analysis of the National Education Longitudinal Study begun in 1988.

Fall Enrollments, Calculus II (thousands)



Fall Enrollments, Calculus III & IV (thousands)



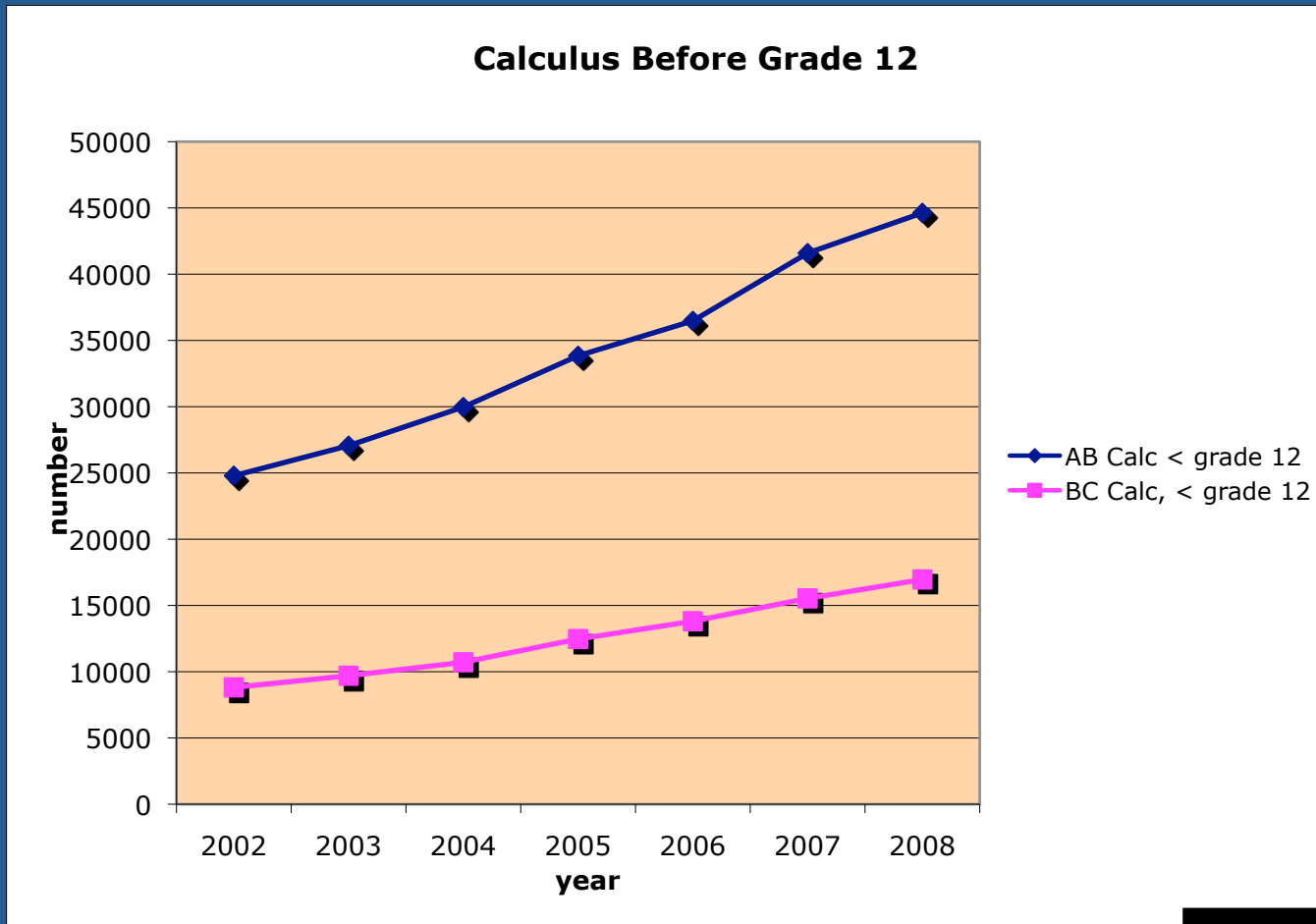
AP Calculus AB has a much broader syllabus than the typical Calculus I.

About $\frac{1}{3}$ of students do well enough to be ready for Calculus II or higher.

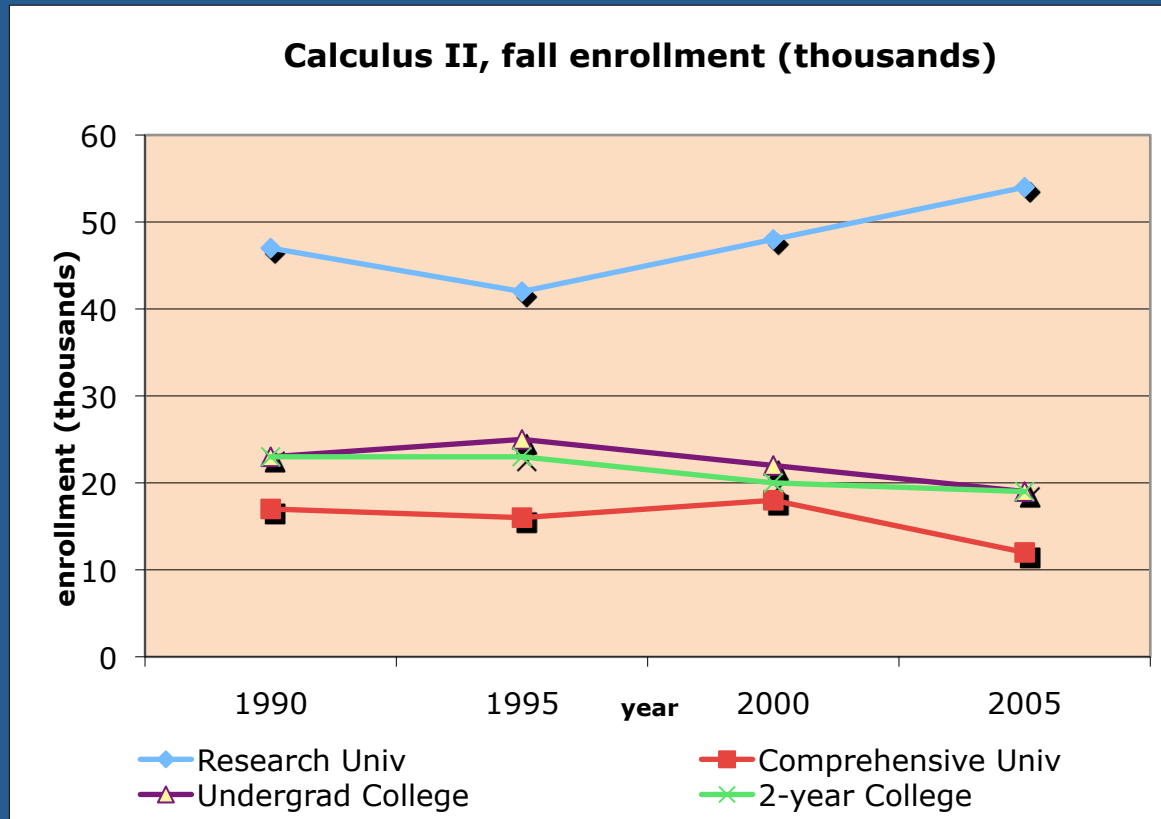
Remainder (300,000–400,000) run into problems when entering the college curriculum.

Many students earn credit for calculus in high school and avoid taking *any* mathematics in college.

We need courses that attract and engage them.

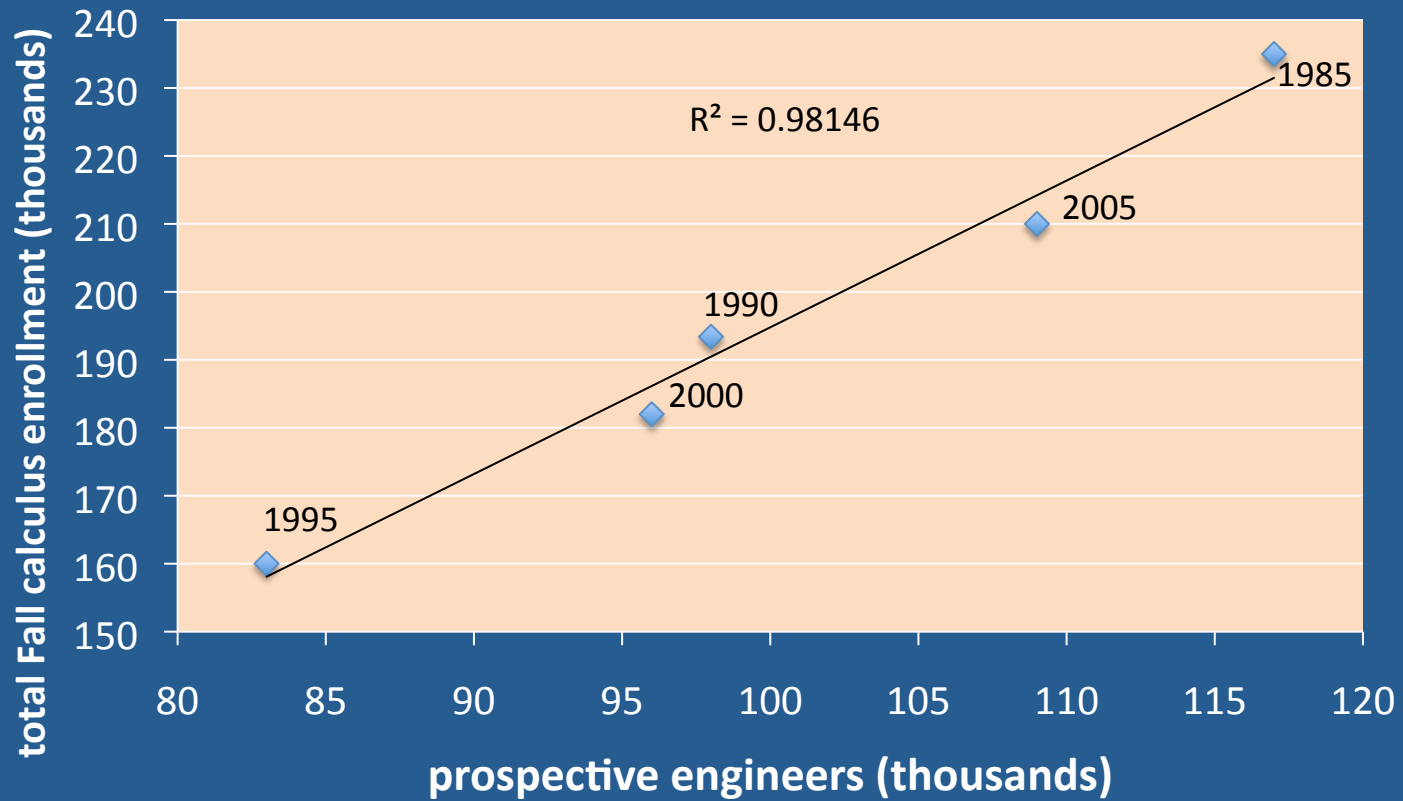


College Board data



Since 1995, there has been a **22% decrease** in the number of students taking Calculus II in the Fall term at comprehensive universities, undergraduate colleges, and 2-year colleges.

of prospective engineers against total fall calculus enrollments in research universities

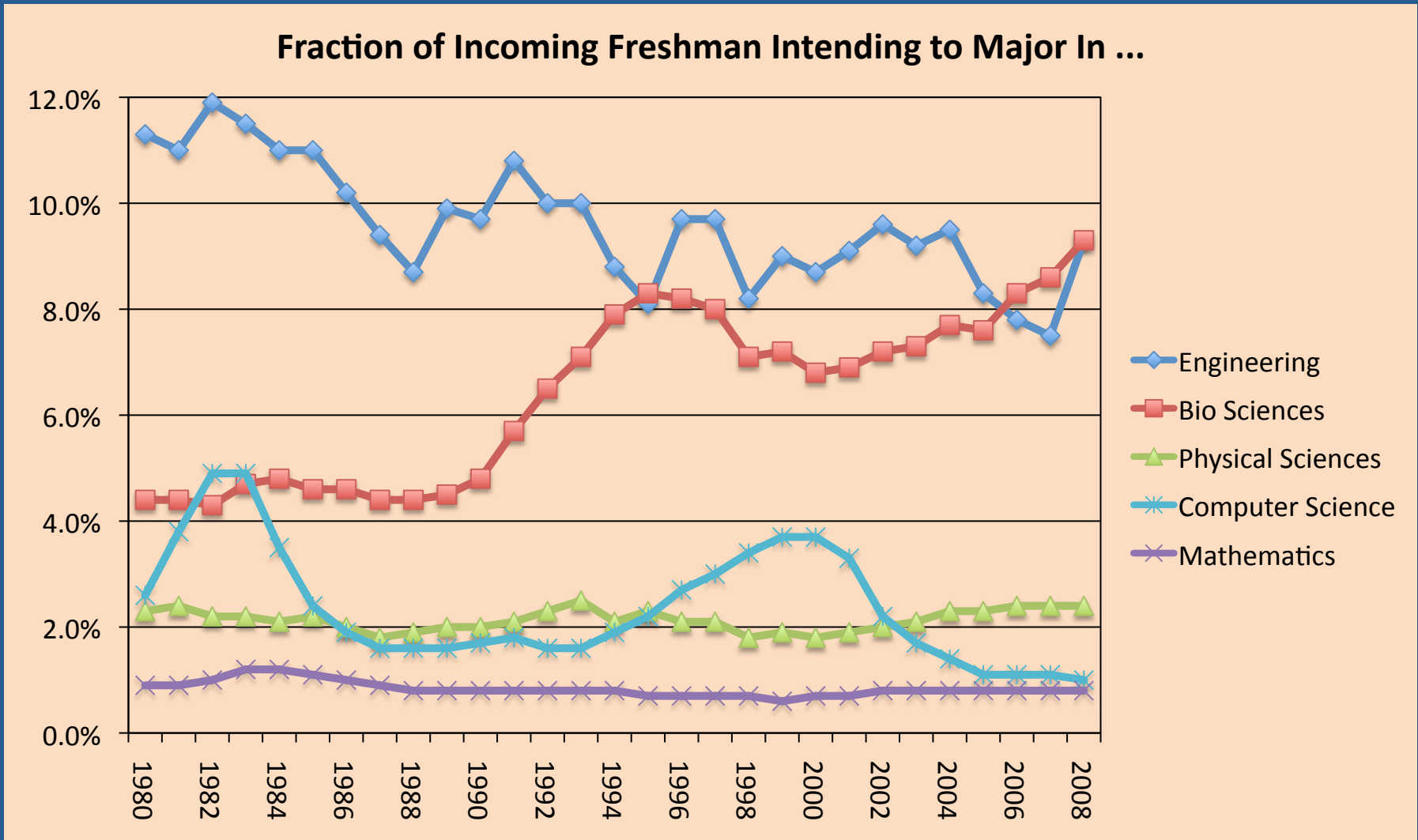


The number of entering first-year students intending to major in Engineering increased by 31% over 1995–2005.

This has kept Calculus II enrollments fairly stable.

The trendline for prospective engineers is downward.

We need courses that are relevant to and attract potential biology majors.



The American Freshman, CIRP data

We need:

- more information about what happens to students in the transition from high school to college,
- more effective means of attracting first-year students to and keeping them interested in mathematics,
- courses that recognize their strengths while addressing their weaknesses, preparing them for higher level courses in mathematics.

“The mathematics profession as a whole has seriously underestimated the difficulty of teaching mathematics.”

Ramesh Gangolli
MER Workshop
May 31, 1991

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