Re-Invigorating the Undergraduate Program in the Mathematical Sciences

Report to the CB-MAA Committee on Mutual Concerns, January 5, 2008

David Bressoud, Macalester College
Whether or not it should be, calculus is the focal point of mathematics education. K-12 math ed is directed toward preparing students for calculus, intermediate and advanced undergraduate courses in mathematics presume calculus as a prerequisite.

The growth of AP and other programs that facilitate the movement of calculus into the high school curriculum has an impact on success in calculus that needs to be better understood.
AP Calculus has been growing at >14,000/year (about 6%)

Estimated # of students taking Calculus in high school (NAEP, 2005): ~ 500,000

Estimated # of students taking Calculus I in college: ~ 500,000 (includes Business Calc)
High School Calculus breakdown:
380,000 take AP Calculus (College Board estimate)
50,000 take IB or Dual Enrollment
70,000 take another course with “Calculus” in the title
High School Calculus breakdown (2007 numbers):
380,000 take AP Calculus (College Board estimate)
276,004 took AP exam; AB: 211,693, BC: 64,311

<table>
<thead>
<tr>
<th><strong>AB exam:</strong></th>
<th><strong>BC exam:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>5: 44,500</td>
<td>28,000</td>
</tr>
<tr>
<td>4: 39,600</td>
<td>11,500</td>
</tr>
<tr>
<td>3: 40,400</td>
<td>12,100</td>
</tr>
<tr>
<td>1–2: 92,500</td>
<td>12,700</td>
</tr>
</tbody>
</table>
About 340,000 students arrived at college this fall having taken calculus in high school but without bringing college credit for it.

From the high school class of 1992, over 30% of those who took calculus in high school enrolled in pre-calculus when they got to college. (Cliff Adleman, National Educational Longitudinal Study of 1988–2000; 31.5%, SE = 2.21).
Colleges and universities need to pay serious attention to these students. They constitute a very large proportion of those who seek mathematically-intensive majors.

We need more data on what happens to these students. We need more information on how to engage and support them.
Mainstream Calculus II Enrollments
(fall only for 2- & 4- year colleges and

![Graph showing Mainstream Calculus II enrollments from 1980-81 to 2007-08. The graph includes data for 4-year colleges & universities, 2-year colleges, and AP Calculus BC only. The data is from CBMS & College Board. The enrollment for 2007 is 64,311.]
BC exam,
8,818 in 2002
15,533 in 2007
76% increase

College Board data
Students completing calculus before their senior year are the best of the best, and their numbers are significant. Do they continue their study of mathematics? How well does their high school experience articulate with college mathematics?
This PowerPoint is available at
www.macalester.edu/~bressoud/talks