Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 104, April 2011

Contents

- -

[1] 7^{th} Edition of *Contemporary College Algebra: Data, Functions, Modeling*

This new edition will be available for Fall classes. Hilary Clark and Isabella Ginn (both of Virginia Commonwealth University) joined Don Small in updating exercises, adding new exercises, writing separate sections for exponential functions and for logarithmic functions, and rewriting in several places. The focus on engaging the student was sharpened by Hilary and Isabella who brought several years of experience teaching the Contemporary course to the rewriting. In particular, student engagement was enhanced by increasing the number of Queries and expanding an enriched selection of exercises.

The basic philosophy of: **Educating Students for the Future rather than Training Them for the Past** is clearly evident in the choice of topics, exercises, and group projects. The goals of the new edition are the same as in previous editions namely: (1) Aid students in developing their problem-solving abilities in the modeling sense, in order to empower students to use mathematics to quantify real-life situations; and (2) Empower students to become exploratory learners, not to master a list of algebraic rules. The emphasis on improving communication skills and on small-group activities remains as does the emphasis on improving student attitudes toward mathematics.

Examination copies can be obtained by contacting Melani Moorman, McGraw-Hill Representative, at 563.584.6358, [melani_moorman@mcgraw-hill.com].

[2] Intermediate Algebra in High School and College: Different Populations Deserve Different Courses

Sheldon P. Gordon
Farmingdale State College
of New York

When many mathematicians are asked how Intermediate Algebra courses in college compare to those in the high school, the response is "They're the same, but just faster and louder". While we could argue about how effective the "faster and louder" approach is, I believe a much more important discussion is needed about the other half of that response:

* Supported by the U.S. Military Academy.

should the two courses be the same? I maintain that they serve vastly different audiences with very different mathematical needs and so should be significantly different courses.

As presently constituted, all intermediate algebra courses are designed with one overarching focus in mind: preparing students algebraically to take calculus. Otherwise, how can you justify such topics as reducing complex fractional expressions, factoring every imaginable kind of polynomial, multiplying products of quadratic expressions, dividing polynomials, synthetic division, solving radical equations with two radicals, and so on? From the perspective of the high schools, this may well be reasonable. Today, there are at least three times as many students taking calculus in high school as in college. Every student who takes calculus takes intermediate algebra in high school. Moreover, virtually every student in college calculus has taken intermediate algebra in high school.

In college, however, the situation is almost completely reversed. Students take intermediate algebra either as a requirement for some other disciplines or to prepare them for a course in college algebra. As I pointed out in a previous article in this Newsletter, only about 15% of students in college algebra are in programs that ever lead to calculus and that is usually business or applied calculus. Only about 10% of the students who successfully complete college algebra ever start Calculus I; only about 2-3% of those who start college algebra ever go on to start Calculus II. Virtually none of the students who come through college algebra ever get to Calculus III.

I am not aware of any comparable studies involving intermediate algebra, but we can make some intelligent estimates. We know that the success rate in developmental courses is typically well under 50%. We also know that relatively few of the students who do complete intermediate algebra successfully actually proceed on to college algebra. Thus, it is reasonable to expect that perhaps on the order of 1% of the students who start intermediate algebra will ever go on to Calculus I; the actual percentage may well be considerably less than that.

Is it reasonable to force 99% of the students in such a course to try to master techniques such as completing the square or any of the other arcane algebraic techniques? The student population in collegiate intermediate algebra is not the same as that in high school. They have very different needs and should not be treated as if they are the same. In another article in this Newsletter, I discussed the mathematical needs of the other disciplines that require college algebra of their students:

- To develop conceptual understanding of the mathematics rather than developing algebraic skills they will never use.
- To understand the role of parameters as they affect the behavior of the members of various families of functions.
- To develop the ability to solve real-world problems via mathematical modeling (usually arising from data). (Think about some of the standard algebra problems we inflict on our students: incredibly artificial age problems, finding the rate at which a canoe is being paddled in still water given how long it takes to go upstream and downstream, and so on.)
- To be exposed to a very different collection of mathematical topics. For instance, a very heavy emphasis on linear, exponential, logarithmic, and power functions; relatively less emphasis on polynomials; no emphasis on rational functions; etc. Also, they should see how to construct functions that fit data (often laboratory data) when the points fall into recognizable patterns.

- The routine use of technology in learning and applying mathematics.

If all this is true of college algebra, it should also be true of the course that feeds into college algebra. We need to rethink the content of intermediate algebra to serve the students we see; we should not be in business simply to try to have every student replicate the program that led us to become professional mathematicians.

Perhaps the first step we need to take to be able to mount effective arguments to convince colleagues to rethink intermediate algebra is to collect some data on student tracking starting in intermediate algebra courses: What are typical success rates? What percentage of those who successfully complete intermediate algebra go on to start college algebra or other successor courses? What percentage of these students actually reach calculus? If nothing else, such information will either confirm or refute some of the points raised above.

If any of the present readers have that kind of data, please forward it to Don Small. If any of you would like to help in this effort, speak to your department chair, your dean, or campus office of institutional research – that kind of data is certainly available on every campus.

Most of us like to think that, by offering the courses that lead directly to calculus, we are leaving the doors open to all students to pursue potential careers in the hard sciences and engineering. But, if the truth is that only about 1% of the students who take intermediate algebra ever get to calculus, which is the threshold, then we are effectively slamming and locking many more doors that prevent 99% of the students from advancing in so many other directions. That strikes me as being cruel and unfair.

[3] Survey Questions

As a follow-up to Shelly Gordon's suggestion in the previous article, please send Don Small [don-small@usma.edu] the following data:

a. (approx.) Percentage of first year math students who are enrolled in Intermediate Algebra.
b. (approx.) Percentage of Intermediate Algebra students who receive a grade of C or better.
c. (approx.) Percentage of successful Intermediate Algebra students who receive a grade of C or better in College Algebra or other successor courses.

Please indicate if your institution is a two-year college, four-year college, or university. Individual schools will not be identified in any reports.
Thanks, in advance, for your response.

[4] College-to-High School Wage Premium

Research by MIT economist David Autor indicates that the return to additional years of education in terms of higher wages has increased over time, and that each year of education adds more to wages than previous years. For example, in 2007, the median increase in earnings associated with an 18th year of education was 19%. The 16th year — or fourth year of college — added 16%, and the first year added 11%.

The wage premium of a college degree compared to a high school diploma is the median wage of a college graduate divided by the median wage of a high school graduate. This ratio is then expressed as a percent. For example, the median hourly wages for college graduates were about 48% more than median hourly wages for high school graduates

in 1981. By 2008, wages for college graduates were almost twice as high as those for high school graduates.

Years	Premium	Years	Premium
1981	48.2%	1996	79.5%
1984	58.9%	1999	88.9%
1987	63.5%	2002	90.7%
1990	70.6%	2005	93.7%
1993	78.6%	2008	96.6%

(Source: Education Pays, 2010)

Do the following:

a. Form a scatter plot of the data.

b. Fit a curve to your scatter plot

c. Predict when the premium will be 100%. That is, when the median wage of a college graduate will be twice the median wage of a high school graduate.

[5] Decay of Cesium 137

An article in The New York Times on March 15, 2011 on the damaged nuclear reactors in Japan, discussed the danger posed by pools holding spent fuel rods. If they were to lose their cooling systems, the water could boil away and fuel rods catch fire spreading radioactive materials. The article said: "cesium 137 in the spent fuel has a half-life of 30 years, meaning that it would take about two centuries to diminish its levels of radioactivity down to one percent." What are the calculations that justify the statement that " it would take about two centuries to diminish its levels of radioactivity down to one percent?"

[6] Notices

1. Melani Moorman is the McGraw-Hill Representative for Contemporary College Algebra 563.584.6358, [melani_moorman@mcgraw-hill.com]

2. Workshop on Refocused College Algebra will be held May 18-20, 2011 at the University of Arkansas, Fayetteville, AR 72701. Don Small and Hilary Clark will be the facilitators. For more information, contact Prof. Deborah Korth [dkorth@uark.edu].

3. Deadline for contributions to the September Newsletter is September 1, 2011. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

4. To subscribe to this Newsletter, write to Don Small, Department of Mathematics, U.S. Military Academy, West Point, NY 10996 or contact him via e-mail at don-small@usma.edu.

Celebrate the Third International Year of the Frog beginning April 29, 2011.