Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

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Contents

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[1] San Antonio College Algebra Initiative

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The city of San Antonio recognized that a failure to complete College Algebra was a key barrier that prevented residents from obtaining a college degree. City-wide, approximately 55% of the college and university students either fail or withdraw from College Algebra. City officials then added the goal of improving mathematics instruction for all students in San Antonio to the city's Strategic Initiative program to enhance the economic future of the region.

* Supported by the U.S. Military Academy.

In January 2003 an invitation from the mayor of San Antonio was sent to each of the nine Institutions of Higher Education (IHE) in San Antonio requesting that a faculty representative attend an initial meeting of a San Antonio College Algebra consortium. The goal of the consortium was to set the goals and priorities of College Algebra across the city to increase student success. The group has been meeting several times a year since February 2003. Discussions have ranged from developing a scope and sequence of College Algebra for the transition from Algebra II to College Algebra, to instituting pedagogical and student support services and developing multiple teaching and assessment strategies, including the integration of technology.

An outgrowth of this initial effort was the establishment of Project BRIDGE (Bringing together Resources from Industry, Development, Government, and Education) to build and sustain dialog between the business and education communities about how best to teach mathematics and science in order to prepare students to enter the San Antonio work force. Funding was obtained from the National Science Foundation to support a San Antonio Algebra/Physics Summit where 36 physics and mathematics teachers from San Antonio public schools, colleges, and universities met in June 2004. These participants were joined by 16 business representatives from diverse San Antonio industries for discussions about how best to build connections between the classroom and the workplace.

As a result of the Summit, other groups were formed, including High School Algebra teachers working with the College Algebra Con-

sortium and parallel groups of High School Physics and college/university physics faculty.

The curriculum reform that began with College Algebra and then Physics has now expanded to biology, language arts and social studies. A different college or university in the city coordinates the work of the high school and university faculty.

Overseeing all these activities is the BRIDGE Steering Committee that is working with the Mayor's office and the Academic Vice Presidents of all nine IHE's in San Antonio to review the progress of the different curriculum groups and to develop strategies to implement the reform recommendations.

[2] Excerpts from CUPM Curriculum Guide 2004

The beginning of a new semester provides a good excuse to reread and think again about the recommendations in the CUPM Curriculum Guide 2004. (The report is available at www.maa.org/cupm/.) The following statements are taken from Part II, Section A, pages 27 and 28.

General education and introductory courses enroll almost twice as many students as all other mathematics courses combined. They are especially challenging to teach because they serve students with varying preparation and abilities who often come to the course with a history of negative experiences with mathematics. Perhaps most critical is the fact that these courses affect life-long perceptions of and attitudes toward mathematics for many students—and hence many future workers and citizens. For all these reasons these courses should be viewed as an important part of the instructional program in the mathematical sciences.

Unfortunately, there is often a serious mismatch between the original rationale for a college algebra requirement and the actual needs of the students who take the course. A critically important task for mathematical sciences departments at institutions with college algebra requirements is to clarify the rationale for the requirements, determine the needs of the students who take college algebra, and ensure that the department's courses are aligned with these findings.

Because many students taking introductory mathematics decide not to continue to higher level courses, general education and introductory courses often serve as students' last exposure to college mathematics. It is important, therefore, that these courses be designed to serve the future mathematical needs of such students as well as to provide a basis for further study for students who do not continue in mathematics. All students, those for whom the course is terminal and those for whom it serves as a springboard, need to learn to think effectively, quantitatively, and logically.

A common feature of many effective courses and programs that have been developed for these students is the leadership provided by key faculty members. It requires committed and talented faculty to understand the needs of these students and the opportunities inherent in these courses. Continuing leadership is needed and special training must be provided for instructors—including graduate assistants and part-time faculty—to offer courses that will meet the needs of these students.

A.1. Offer suitable courses. All students meeting general education or introductory requirements in the mathematical sciences should be enrolled in courses designed to

- Engage students in a meaningful and positive intellectual experience;

- Increase quantitative and logical reasoning abilities needed for informed citizenship and in the workplace;
- Strengthen quantitative and mathematical abilities that will be useful to students in other disciplines;
- Improve every student's ability to communicate quantitative ideas orally and in writing;
- Encourage students to take at least one additional course in the mathematical sciences.

[3] Small Group Activities

These three problems are examples of small group activities for the classroom. Fifteen minutes is a reasonable amount of time for each one— ten minutes for solving the problem and five minutes for one or two groups to present their solution to the rest of the class.

A. You purchase a gallon of paint to paint your room. One gallon of paint will cover 350 square feet.

a. If your rectangular shaped room measures 11 x 13 feet and the ceiling is 8 feet high, will you have enough paint? Explain why or why not.

b. If there are two 3 x 5 foot windows and one door that is 3 x 7 feet, will you have enough paint? Explain why or why not.

B. When ticket prices (P) for a baseball game are \$10 per game, the average attendance (A) is 27,000. Lowering the price by \$2 increased the attendance to 33,000. If the relationship between average attendance and ticket price is linear, develop a linear equation relating attendance and ticket price.

C. Let $H(t)$ be the height in meters of a launched projectile, t seconds after lift-off. Assume that $f(x)$ is the inverse function to $H(t)$. Explain in words, what $f(300)$ represents.

[4] Interpreting the Meaning of Slope

The rate of change concept is central to any study of change. Thus the concept of slope, as a rate of change, deserves a full class discussion. The following list of statements and questions is offered as stimulants to an in-depth discussion of slope.

- Slope is presented graphically as rise over run, in function language as change in output over change in input, and algebraically as an average rate of change. How can a quotient represent a rate of change?
- When \$100 is invested at 4% annually, the plot of interest versus time (years) is a straight line. How is the slope of the line interpreted in terms of the investment?
- Hook's Law states (for small displacements) the restorative force of a spring is proportional to the spring's displacement (i.e., the length that the spring has been stretched or compressed). Thus the force is a linear function of the spring's displacement and the corresponding graph is a straight line. How is the slope of the line interpreted in terms of the spring.
- Explain why a linear function is said to be increasing (decreasing) if its slope is positive (negative).
- A distance (ft) versus time (sec) plot of a car that speeds up from a stop position is probably not a straight line. Suppose (2,20) and (10, 800) are two points on the plot. The average rate (800-10)/(10-2) is approximately 75 mph. This average rate is the slope of what line?

- What is the difference between average rate and instantaneous rates of change? What type of change does the speedometer of your car register?

- Is f a linear function if its rate of change is a constant? Explain.

- If the graph of the distance a car has traveled as a function of the gallons of gas consumed is a straight line, interpret the meaning of the slope of the graph.

[5] Notices

1. The Joint Mathematics Meetings will be held in Atlanta, GA, January 5-8, 2005. Sessions of special interest are:

   Contributed Paper Session (Wednesday 8-10:55; Friday 1-5:50) "Courses Below Calculus: A New Focus"

   Panel (Wednesday 3:50-5:10) "Refocused College Algebra, A Basis for QL Programs"

   Poster Session (Friday 1-3:00)

   Panel (Saturday 2:30-3:50) "Open Discussion on Refocusing the Courses Before Calculus"

2. Deadline for contributions to the February Newsletter is February 1, 2005. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

3. 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.