Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

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[1] College Algebra Guidelines

Bill Haver
Virginia Commonwealth University

(Bill Haver is Chair of the MAA's committee on Curriculum Renewal Across the First Two Years (CRAFTY).)

Over the past two years, the MAA's CRAFTY committee has developed its College Algebra Guidelines. In October 2006 the committee unanimously approved the Guidelines and is recommending that all colleges and universities take the steps to assure that their offerings of college algebra be focused on solving problems presented in the "context of real world situations with emphasis on model creation and interpretation".

The Guidelines describe explicit course goals, competencies to be achieved by the student, pedagogical goals and assessment expectations. The Guidelines provide a detailed description of how a College Algebra course could satisfy the recommendations of the CUPM Curriculum Guide: 2004. Those of us who have surveyed the national scene are well aware that the overwhelming majority of the one million students who enroll in College Algebra each year are not enrolled in courses that provide the type of experience described in the Guidelines. The members of CRAFTY are convinced that not only is the course described in the Guidelines desirable for all students, but also that the offering of such a course can become common practice nationwide. There are a number of reasons why such a large change can occur:

- A growing number (but still impacting a tiny percentage of the students enrolled in college algebra) of institutions are offering courses that meet these guidelines.
- Generally speaking, the faculty who teach these courses are finding the experience rewarding and student persistence in these courses appears to be significantly higher.
- A number of interesting textbooks have been developed and are being developed that can be used to offer such a course.
- At the institutional level, many colleges and universities are concerned about the high withdrawal and non success rate of their students enrolled in College Algebra. The American Association of State Colleges and Universities has identified student success rate in freshman mathematics as an area needing high priority study.
- The 2006 Beyond Crossroads recommendations of the American Mathematical Association of Two-Year Colleges are consistent with those of the CRAFTY College Algebra Guidelines.

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College Algebra Guidelines

These guidelines represent the recommendations of the MAA/CUPM subcommittee, Curriculum Renewal Across the First Two Years, concerning the nature of the college algebra course that can serve as a terminal course as well as a pre-requisite to courses such as pre-calculus, statistics, business calculus, finite mathematics, and mathematics for elementary education majors.

Fundamental Experience

College Algebra provides students a college level academic experience that emphasizes the use of algebra and functions in problem solving and modeling, provides a foundation in quantitative literacy, supplies the algebra and other mathematics needed in partner disciplines, and helps meet quantitative needs in, and outside of, academia. Students address problems presented as real world situations by creating and interpreting mathematical models. Solutions to the problems are formulated, validated, and analyzed using mental, paper and pencil, algebraic, and technology-based techniques as appropriate.

Course Goals

- Involve students in a meaningful and positive, intellectually engaging, mathematical experience;
- Provide students with opportunities to analyze, synthesize, and work collaboratively on explorations and reports;
- Develop students' logical reasoning skills needed by informed and productive citizens;
- Strengthen students' algebraic and quantitative abilities useful in the study of other disciplines;
- Develop students' mastery of those algebraic techniques necessary for problem-solving and mathematical modeling;
- Improve students' ability to communicate mathematical ideas clearly in oral and written form;
- Develop students' competence and confidence in their problem-solving ability;
- Develop students' ability to use technology for understanding and doing mathematics;
- Enable and encourage students to take additional coursework in the mathematical sciences.

Competencies

1. Problem Solving

Goals for students include

- solving problems presented in the context of real world situations with emphasis on model creation and interpretation;
- developing a personal framework of problem solving techniques (e.g., read the problem at least twice; define variables; sketch and label a diagram; list what is given; restate the question asked; identify variables and parameters; use analytical, numerical and graphical solution methods as appropriate; determine plausibility of and interpret solutions);
- creating, interpreting, and revising models and solutions of problems.

2. Functions and Equations

Goals for the students include

- understanding the concepts of function and rate of change;
- effectively using multiple perspectives (symbolic, numeric, graphic, and verbal) to explore elementary functions;
- investigating linear, exponential, power, polynomial, logarithmic, and periodic functions, as appropriate;
- recognizing and using standard transformations such as translations and dilations with graphs of elementary functions;
- using systems of equations to model real world situations;
- solving systems of equations using a variety of methods;
- mastering algebraic techniques and manipulations necessary for problem-solving and modeling in this course.

3. Data Analysis

Goals for the students include

• collecting (in scientific discovery or activities, or from the Internet, textbooks, or periodicals), displaying, summarizing, and interpreting data in various forms;

• applying algebraic transformations to linearize data for analysis;

• fitting an appropriate curve to a scatter plot and use the resulting function for prediction and analysis;

• determining the appropriateness of a model via scientific reasoning.

Emphasis in Pedagogy

Goals for the instructor include

• facilitating the development of students' competence and confidence in their problem-solving abilities;

• utilizing and developing algebraic techniques as needed in the context of solving problems;

• emphasizing the development of conceptual understanding of the mathematics by the students;

• facilitating the improvement of students' written and oral mathematical communication skills;

• providing a classroom atmosphere that is conducive to exploratory learning, risk-taking, and perseverance;

• providing student-centered, activity-based instruction, including small group activities and projects;

• using technology (computer, calculator, spreadsheet, computer algebra system) appropriately as a tool in problem-solving and exploration;

• conducting ongoing assessment activities designed to determine when mid-course adjustments are warranted.

Assessment

• Assessment tools will measure students' attainment of course competencies, including:

  * solving problems and interpreting results using algebraic tools;
  * building and interpreting models and predicting results;
  * communicating processes and solutions orally and in writing;
  * making quantitative and algebraic arguments;
  * reading and interpreting data presented in various forms.

• Assessment tools will include

  * individual quizzes;
  * individual examinations;
  * additional activities or assignments, such as: individual or group homework, projects, and activities; individual or group oral presentations; portfolios that demonstrate student growth; group quizzes and exams.

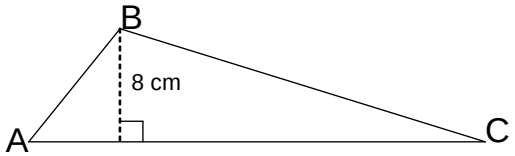
• The course will be assessed by analyzing its effectiveness in:

  * facilitating student achievement of the course competencies;
  * positively affecting student attitudes about mathematics;
  * preparing students for subsequent courses in mathematics and mathematics-dependent disciplines;
  * preparing students for subsequent endeavors in and outside academia.

[2] Class Quickies

The following four *Class Quickies* are examples of short (quick) exercises that can be given to start off a class on a participatory mode or to reengage students who have drifted off during class.

a. Given the following triangle ABC with an area of 40 cm^2, what is the length of side AC?



b. Where does the graph of $f(x) = x^2 - 3x$ cross the x-axis?

c. The volume of a rectangular box with a base of 2 feet by 18 inches is 15 cubic feet. How tall is the box (in feet)?

d. Given $f(z) = 3z - 12$ and $g(t) = 3t^2$, is $f(g(2)) = g(f(2))$? Explain.

[3] Population Predictions

The New York Times reported on October 18, 2006 that the population of the United States had passed the 300 million mark. The article contained some interesting data. For example:

Year	Population (millions)
1790	4
1915	100
1967	200
2000	280
2006	300

The article also noted that a baby was born every 7 seconds, a person dies every 13 seconds, and a new immigrant arrives every 31 seconds. Using this information, do the following:

a. Fit three functions to the population data (linear, quadratic, exponential) and determine the one of best fit. Explain your reasoning.

b. Use your "best fit" function from Question 1 to predict in what year the population will reach 400 million and then repeat for 500 million.

c. Use the birth, death, immigration data to determine a yearly population growth rate.

d. Assume the yearly population growth rate from Question 4 remains constant. In what year will the population first exceed 400 million?

e. Write a statement reflecting on your answers to c and d.

[4] Notices

1. The MAA will host a conference, November 9-11, 2006, entitled "Algebra: Gateway to a Technololgical Future". One of the Break Out groups will be on College Algebra. Comments are welcome, e-mail them to Bill Haver (whaver@vcu.edu) or Don Small (donsmall@usma.edu)

2. A panel session on *Refocusing College Algebra* will be held Monday morning at 9:00 am on January 8, 2007 as part of the Joint Mathematics Meeting in New Orleans. The panelists will be representatives of the six HBCU schools participating in the NSF funded HBCU Retreat and Follow On program. The panelists will discuss their experiences in refocusing their college algebra courses.

3. Laurette Foster and Don Small will present a minicourse at the Joint Mathematics Meetings in New Orleans, January 5-8, 2007. The title of the minicourse is *Contemporary College Algebra: A Refocused College Algebra Course.* Part A will be offered on Friday, 2:15 to 4:15 pm and Part B will be offered on Sunday, 3:30 to 5:30 pm.

4. Deadline for contributions to the January Newsletter is Friday, January 5, 2007. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

5. 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.