Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
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[1] Excerpts from the *Curriculum Foundations Project - Voices of the Partner Disciplines*

The Curriculum Foundations Project was a major undertaking of the MAA's CUPM subcommittee on Curriculum Renewal Across the First Two Years (CRAFTY). The objective was to hear the views of partner disciplines concerning the mathematics curriculums for the first two years. This was accomplished through eleven discipline-based workshops held durng the period 1999-2001. Each workshop brought together 20-35 faculty,

* Supported by the U.S. Military Academy.

most of whom represented the discipline under question with the remainder chosen from mathematics. The purpose of each workshop was for members of the partner discipline to dialogue about their mathematical needs (desires) while the mathematicians listened and served as resources. The Summary and final report of the Project, *Curriculum Foundations Project, Voices of the Partner Disciplines*, was published by the MAA. The entire report is available on-line at www.maa.org/cupm/crafty.

The reports from each of the workshops explicitly recommended problem solving and modeling. The majority of the reports called for more emphasis on developing communication skills and conceptual understanding. The specific recommendations for college algebra as written in the Summary is reproduced here.

"**Replace traditional college algebra courses with courses stressing problem solving, mathematical modeling, descriptive statistics, and applications in the appropriate technical areas. De-emphasize intricate algebraic manipulations.**

College algebra courses serve two distinct student populations: the overwhelming majority for whom this is a terminal course in mathematics, and the relatively small minority for whom it is a gateway to further mathematics. Neither group is well-served by the traditional version of the college algebra course. Many of the disciplinary workshops recommended the reorganization of college algebra and precalculus courses to better meet the

needs of various student populations. In particular, the obvious mismatch between a curriculm designed to prepare students for calculus and the reality that very few of these students subsequently enroll in calculus caused the Summary Curriculum Foundations Conference participants to recommend changes stressing problem solving, modeling, statistics, and applications."

With respect to technology, the Report states: "Technology should be used in introductory mathematics courses to provide students with tools for solving problems." However, the Report makes clear that teachers "must stress to students the importance of choosing the appropriate method of calculation (mental, paper-and-pencil, or technology) for the desired task." An interesting outcome of the discussions on technology was the strong consensus that spreadsheets are the technology of choice for many of the partner disciplines.

[2] The Wind Doth Blow

Wind power holds great potential as a major renewable source for electricity. Although accounting for less than one percent of the country's energy generation today, the development of wind farms is growing rapidly. *Wind Energy* predicts that by 2020 up to six percent of our country's electrical energy will be generated from wind-power. (Presently, 20% of Denmark's electricity is generated from the wind.) The company claims that with today's technology, wind power could generate enough electricity to supply the country's needs. In fact, they predict that North Dakota alone could supply 40% of today's needs. The fast growth of the industry is due largely to technological improvements over the past twenty years that have increased the efficiency of windmills and decreased the costs. For example, a large windmill in 1980 stood about a 100 feet tall and had 40 foot blades. Today, a large windmill stands about 350 feet tall and has 115 foot blades. Because wind velocities are decreased near the ground due to friction with the earth's surface, wind velocities at the high towers may be several times as great as those near the surface. This increased velocity makes today's larger windmills much more efficient and productive than those of a few years ago.

The following data (taken from USA Today, January 5, 2005) measures the amount of wind generated electricity in terms of the number of typical U.S. Households supplied.

Year	# Households
1982	302
1987	183,400
1992	297,200
1997	335,100
2004	1,600,000

Plot this data and then determine a fourth degree polynomial whose graph contains each data point in the scatter plot. Proceed in the following manner.

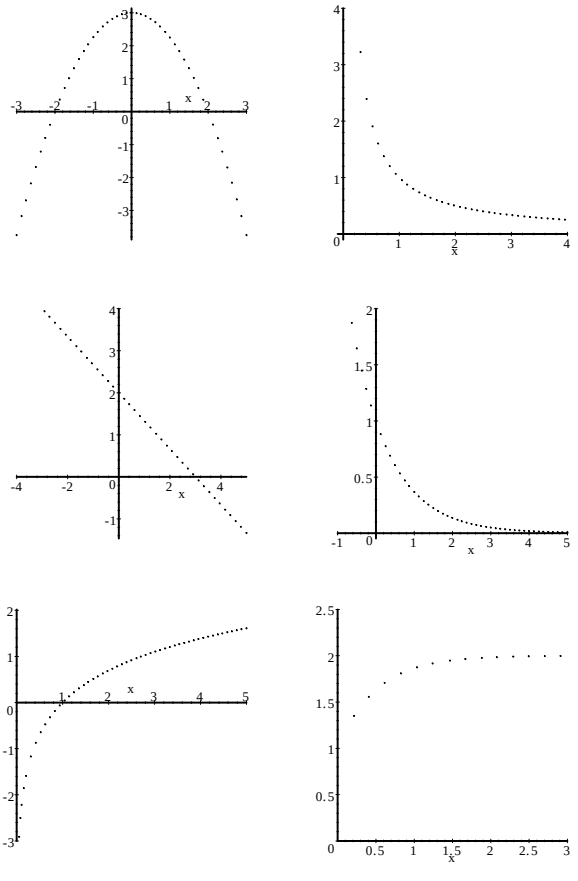
> Let $f(x) = c_0 + c_1x + c_2x^2 + c_3x^3 + c_4x^4$.
>
> Substituting a data point into this equation yields one equation in five unknowns $(c_0, c_1, c_2, c_3.c_4)$.
>
> For example, substituting the first data point, (1982, 302), yields the equation $302 = c_0 + 1982c_1 + 1982^2c_2 + 1982^3c_3 + 1982^4c_4$.
>
> The five data points thus give a system of five equations in five unknowns.
>
> Solve this system for the five unknowns (the coefficients) by converting the system to a matrix equation and then using the reduced row echlon command applied to the augmented matrix.

Superimpose the graph of f on the scatter plot.

Predict the number of households whose electricity needs will be met in 2010. Explain the assumptions you made in forming your prediction.

[3] Identifyng Scatter Plots

A common modeling procedure is to gather data, plot the data, and then fit a curve to the resulting scatter plot. This last step depends, in part, on recognizing the shape of the scatter plot. The following is an interesting way to test our students' skills ability to recognize basic shapes. For each of the following scatter plots, identify a reasonable choice of function to fit the scatter plot.



[4] Figuring the Cost of a Sail

(The first two parts of this problem are straight forward in terms of problem solving, but the third part is not as there are several ways of aligning/cutting the 6 foot wide material to form the sail.)

The Wind Sail Company charges $25 per square foot for a triangular shaped sail with side lengths 33 feet, 27 feet, and 21 feet.

a. Is the shape of the sail a right triangle? Explain your reasoning.

b. Determine the cost of the sail. Using a sketch, explain how you obtained your answer.

c. If the sail material comes in 6 foot widths, how many feet of material would you need? Illustrate your approach with a sketch and then explain your reasoning? Is your answer the minimum necessary? Explain.

[5] Request for Information on College Algebra Courses

The MAA, AMATYC, and NCTCM have joined forces to assess how well college algebra courses meet the needs of the students who are taking them. In particular, they are interested in collecting data on answers to the following questions:

Who are the students who take college algebra?

What percentage of students are successful in college algebra?

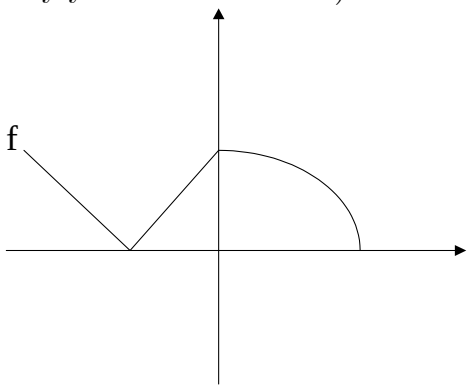
What percentage of college algebra students take additional mathematics courses and how well do the students do in these courses?

What percentage of college algebra students enter calculus I?

If you or your department has conducted any studies involving these questions and are willing to share the results, please contact Sheldon Gordon (gordonsp@farmingdale.edu) or Bill Haver (wehaver@vcu.edu) or Don Small (don-small@usma.edu).

[6] Quiz Activity

This activity involves shifting and scaling a graph. Let the function f be defined by the following plot. Hand a copy of the graph of f to each pair of students and then have them superimpose the graphs of functions $g1$ through $g4$ defined below. (Copying the graph of f on a sheet of graph paper would probably yield better results.)



a. $g1(x) = f(-x)$ b. $g2(x) = -f(x)$
c. $g3(x) = f(x-1)$ d. $g4(x) = 2f(x) - 2$

True merit is like a river,
the deeper it is the less
noise it makes.

Anon

[7] Notices

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

2. 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.