

# *Vision - Potential*

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium\*

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## **[1] HBCU Retreat and Follow-On Program**

The HBCU Retreat and Follow-On Program is sponsored by the U. S. Military Academy and funded by the National Science Foundation (NSF) and the Army Research Office (ARO). The purpose of the program is to assist HBCUs in refocusing their college algebra programs. The first cohort consisting of six schools began the program in June of 2006. A second cohort of five schools joined the program in 2007 and applications are now being received for the third cohort which will join the program in June 2008.

A national movement has evolved over the past few years to move college algebra away from the symbolic, algorithmic, and skill based program that has characterized it since the 1960s to a course focused on the types of quantitative questions students will en-

\* Supported by the U.S. Military Academy.

counter in society, in the work place, and in other disciplines. In short, refocusing college algebra means developing a course that educates students for the future rather than training them for the past.

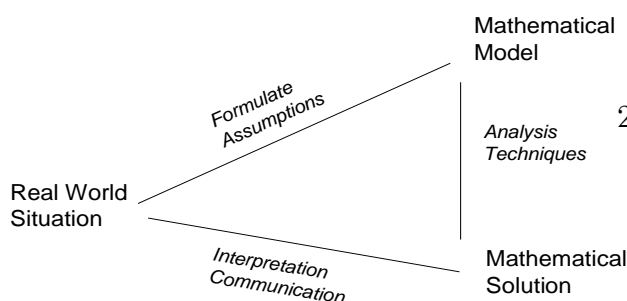
In support of this movement, NSF and ARO funded the "HBCU Retreat and Follow-On" Program to assist HBCUs to refocus their college algebra courses. Participating schools send a 2-3 person team to the U.S. Military Academy at West Point, NY for a four-day retreat in June. The retreat begins with discussions on the "Why, What, and How" of refocusing College Algebra, proceeds to hands-on experiences with small group activities/projects, and concludes with each team drafting a syllabus for a refocused program at their school. During the summer, each team refines its syllabus, develops materials, and prepares to implement their new course in multiple sections for at least the following four semesters. Each team is assisted by a mentor who works with the team during the Retreat and makes on-site visits during the first year.

The refocused content includes elementary data analysis, stresses graphing and interpreting graphs, and places a strong emphasis on real-world problem solving in the modeling sense. Of particular importance is the ability to plot data, fit a curve to the scatter plot, and use the resulting function for predictive purposes. Algebraic skills are taught as their

need arises in the context of real-world situations.

The use of graphing calculators, spreadsheets, and computer algebra systems has fundamentally changed the traditional notion of problem solving. The change is from focusing on a computational process to one that emphasizes model formulation and interpretation while relying on technology to assist in the computational requirements.

**Problem Solving/Modeling Process**



A refocused college algebra course emphasizes creative problem solving – leveraging the power of human reasoning to formulate and interpret, while using the power of technology to calculate.

The pedagogy of a refocused course is student oriented. It is a pedagogy that focuses on questioning and generating questions, on what-ifying, on fostering inquisitiveness, on making approximations, on small group work, on activities and projects that lead students into new areas, on student presentations, etc. In short, it is a pedagogy whose primary goal is to aid and support students to become exploratory learners.

The importance of the refocused curriculum was articulated in the 2004 MAA report, *Voices of the Partner Disciplines*. Faculty members in other disciplines recommended that mathematics departments “Replace traditional college algebra courses with courses stressing problem solving, mathematical modeling, descriptive statistics, and applications in the appropriate technical areas”

and “de-emphasize intricate algebraic manipulations.”

There are eleven schools actively participating in the program at this time. Five additional schools (three of which have already been selected) will join the program this June. The schools are:

2006 Cohort

1. Albany State University
2. Florida Memorial University
3. Fort Valley State University
4. Howard University
5. Savannah State University
6. Virginia State University

2007 Cohort

7. Fayetteville State University
8. Paine College
9. Prairie View A&M University
10. Southern University
11. University of the District of Columbia

**[2] Acceleration of a Honda Civic Si**

The November 2007 issue of *Motor Trend* gave the following data on the acceleration of a Honda Civic Si:

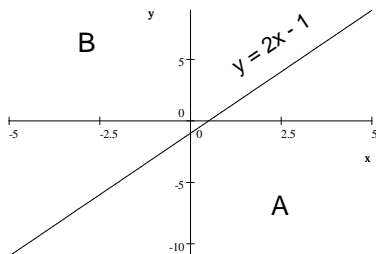
Acceleration to mph	Time (seconds)
0 - 30	2.7
0 - 40	3.9
0 - 50	5.1
0 - 60	6.7
0 - 70	8.7
0 - 80	10.9
0 - 90	14.0
0 - 100	17.4

Display this data in a scatter plot and then fit a curve to the data points.

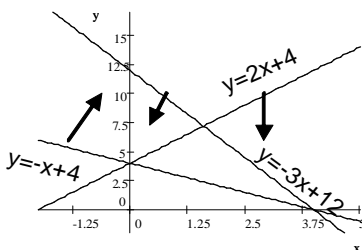
- a. Using the curve function, predict the time to accelerate from 0 to 110 mph.
- b. In the acceleration from 0 to 100 mph, estimate the speed at the point of the greatest rate of change. Explain your reasoning.

### [3] Half Planes

A linear inequality, say  $y \leq 2x - 1$ , divides the Cartesian plane into two half planes labeled A and B as shown in the following graph.



Half-Plane A consists of all the points  $(x, y)$  satisfying the linear inequality  $y \leq 2x - 1$ . (Half-Plane B consists of all the points satisfying the linear inequality  $y > 2x - 1$ .) The following multiplot shows a triangular region in the plane defined by the three linear inequalities:  $y < 2x + 4$ ,  $y > -x + 4$ ,  $y < -3x + 12$



Does the point  $(2, 5)$  lie in the region? Explain your reasoning.

### [4] Linear Programming Question

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(The following is a slight modification of a problem that appeared in the 2007 Final Exam of a refocused college algebra course at Paine College.)

The Jillson's have up to \$75,000 to invest. They decide that they want to have at least \$25,000 invested in stable bonds yielding 6%

and that no more than \$45,000 should be invested in more volatile bonds yielding 12%. Determine the amount that should be invested in each category of bonds in order to maximize their yield subject to their constraints. In particular:

- Define the variables.
- Define an objective function.
- Using inequalities, express each of their investment constraints.
- Graph the feasible region (i.e., region defined by the investment constraints).
- Determine the amount the Jillson's should invest in each category of bonds in order to maximize their yield.
- Determine the maximum yield possible subject to the constraints.

### [5] Query

Can 16 be expressed as the sum of three odd integers? If your answer is Yes, give an example and then determine if that is the only possible example. If your answer is No, explain your reasoning.

### [6] Problems from "Greek Anthology"

(These problems are copied from *An Introduction of the History of Mathematics*, fourth edition, by Howard Eves, p. 163.)

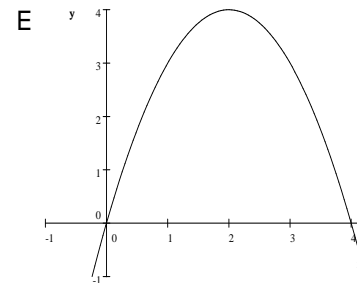
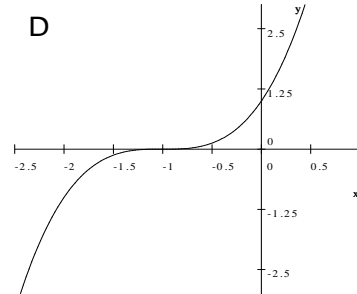
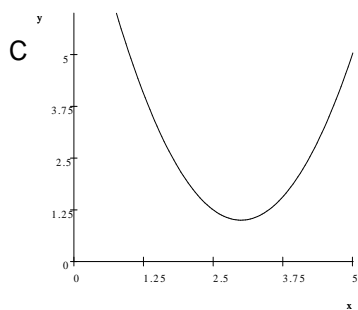
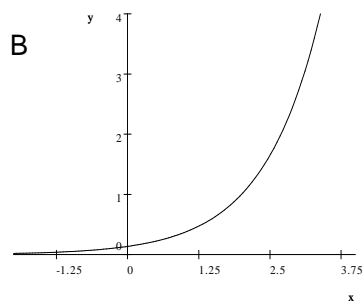
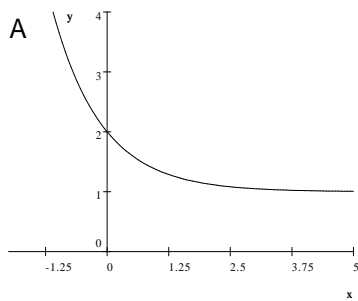
- How many apples are needed if four persons of six receive one third, one eighth, one fourth, and one fifth, respectively, of the total number, while the fifth receives ten apples, and one apple remains left for the sixth person?
- Demochares has lived a fourth of his life as a boy, a fifth as a youth, a third as a man, and has spent 13 years in his dotage. How old is he?
- After staining the holy chaplet of fair-eyed Justice that i might see thee, all-subduing

gold, grow so much, I have nothing; for I gave 40 talents under evil auspices to my friends in vain, while, O ye varied mischances of men, I see my enemies in possession of the half, the third, and the eighth of my fortune. (How many talents did the unfortunate man once possess?)

d. The Graces were carrying baskets of apples, and each one was the same number. The nine Muses met them and asked for apples and they gave the same number to each Muse, and the nine and the three each had the same number. Tell me how many they gave and how they all had the same number. (This problem is indeterminate. Find the smallest permissible solution.)

### [7] Identifying Graphs

Each of the following curves is the graph of a power function or an exponential function that has been shifted. Write a possible formula for each function.



### [8] Notices

1. Past issues of the *Vision - Potential* Newsletter are available on our website: [www/ContemporaryCollegeAlgebra.org](http://www/ContemporaryCollegeAlgebra.org).
2. Deadline for contributions to the March Newsletter is March 1, 2008. 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](mailto:don-small@usma.edu).