Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
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[1] Vision for a Refocused College Algebra

Professional organizations issue vision guidelines from time to time. The National Council of Teachers of Mathematics (NCTCM) issued its *Principles and Standards* in April 2000 that provided a detailed vision for K-12 mathematics. The American Association of Two Year Colleges (AMATYC) presented its vision of the first two years of college mathematics in its *Crossroads* publication. The following "Vision for a Refocused College Algebra" lies at the interface of the *Principles and Standards* and the *Crossroads* documents. This statement will be presented to the CRAFTY committee of the

* Supported by the U.S. Military Academy.

Mathematical Association of America (MAA) for their consideration and then the (revised) statement will be presented to the joint committee on college algebra of the NCTCM, AMATYC, and the MAA. Readers are invited (urged) to send their comments on this statement to Don Small [don-small@usma.edu], editor of the *Vision-Potential* Newsletter.

Vision for a Refocused College Algebra

1. Goal

Encourage students to become exploratory learners while developing an analytical basis for students to address the quantitative needs encountered in the academy, society, and the work place.

2. Fundamental Experiences

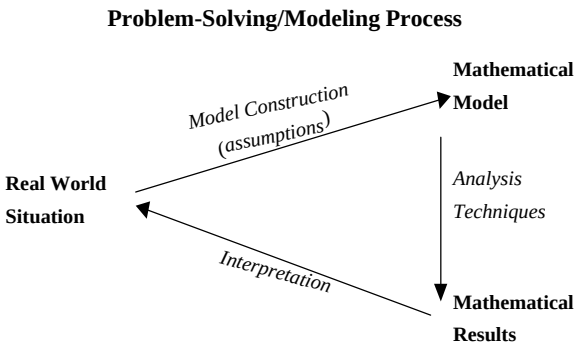
The student will experience a program that emphasizes creative problem solving—leveraging the power of human reasoning to formulate and validate, while using the power of technology to calculate.

Emphasis is on

a. Small-group work—in class activities, out of class projects.
b. Communication skills—writing, presenting, reading, listening
c. Real life problems (modeling, solving)
d. Appropriate use of technology—graphing calculator or computer (spreadsheet)
e. Development of student confidence and self-esteem

3. Problem Solving

The student will experience problem solving of real world situations according to the following diagram.



Strong emphasis is placed on the model creation and interpretation stages while the use of technology reduces the emphasis on the solution techniques stage.
The student will develop problem solving heuristics—read the problem at least twice, define variables, sketch and label a diagram, list what is given, and state the question asked, etc.
The student will experience using the model creation and problem solving method of successive approximations.

4. Data Analysis
The student will experience collecting and plotting data. Then fitting a curve to the scatter plot and using the resulting function for predictive purposes. The student will

a. Collect data
b. Display data—bar, table, and circle charts; line and scatter plots
c. Compare and contrast average, median, and mode
d. Use data for predictive purposes (fit a curve to a scatter plot)

5. Functions
The student will understand function as an "input - output" relation subject to a uniqueness property.
The student will

a. Discover, develop, and work with four categories of functions: Power, Exponential, Logarithmic, Periodic (sine, cosine)
b. Understand the multi representation of functions (graphic, numeric, symbolic)
c. Understand how to fit a curve to a scatter plot (graphically, analytically)

6. Algebraic Systems
The student will experience using systems of equations in modeling real world situations.
Students will solve

a. Systems of linear equations by various methods (substitution, matrix, graph)
b. Systems of non-linear equations by various methods (substitution, graph)

Footnotes

a. Pedagogy—student centered, activity-centered, reduced lecture time
b. Emphasis is on developing students to be confident and competent problem solvers.
c. Algebraic techniques are developed when needed to solve a meaningful problem.
d. Mastery of algebraic techniques is not a goal of the course.

[2] What is the Surface Area of the Washington Monument?

The monument is shown in the following figure and its important dimensions are listed. The architectural shape of the monument is an obelisk (a thin, four-sided, tapering monument which ends in a pyramidal top). Notable examples of such structures are seen among the monuments of ancient Egypt.

Dimensions of Washington Monument

Total height of monument	555.4 feet
Width of base	55.0 feet
Height of pyramidal top	505.0 feet
Width of pyramidal top	34.4 feet

Note.
The sides of the main column taper forming a trapezoidal shape. The sides also slant as do the sides of the pyramidal top.
Hint. Geometrically determine the area of a trapezoid by drawing a trapezoid and then dividing it into two right triangles and a rectangle.

[3] Puzzles

1. A right triangle has sides with lengths x, y, and z where z is the hypotenuse of the triangle. The area of the triangle is $\frac{z^2}{4}$. Is the triangle isosceles? Why or why not?
Hint. A triangle is said to be isosceles when two of its sides are of equal length.

2. You have a pile of 24 coins. Twenty-three of these have the same weight, and one is heavier than the others. You have a beam balance scale, which will compare the weights of any two sets of coins. Determine the minimum number of weighings which will always identify the heavier coin.

[4] Test Questions

1. Hurricanes have soaked the southern and eastern sections of our country this year. Suppose a person records the following data from his rain gauge.

Time (hrs)	Amount (in)
0	0
1	1.1
2.5	4
4	6
7	10.3
8	11.5

a. Plot this data and fit a linear model to the scatter plot.
b. What is the slope of the line?
c. Give a physical interpretation of the meaning of the slope.
d. Determine the average rate of rainfall over the 8 hour period.
e. Approximate the amount of rain that fell during the first five hours.

The following two questions were taken from a test that Yvette Stepanian (Virginia Commonwealth University) prepared for a Contemporary College Algebra course.

2. The price of a color printer is reduced by 30% of its original price. When it still does not sell the sale price is reduced further by 20%. The salesperson informs you that there has been a total reduction of 50% from the original price.

Is the salesperson's statement correct? If not what is the correct percent reduction from the original price?

3. Women employees of a ten person (5 women, 5 men) firm have complained of sex discrimination in the company's pay scale. If the women win their case, the firm will have to raise the salaries of all underpaid employees. Three of the women are paid \$23,000, one is paid \$27,000, and one is paid \$55,000. The salaries of the five men are \$24,000, \$28,000, \$30,000, \$32,000, and \$36,000.

a. What is the mean salary of all employees?
b. What is the mean salary for women? For men?
c. What is the median salary for women? For men?
d. If you were a lawyer acting for the firm, which measure (of central tendency) would you use to describe the salaries of all the employees as a group? Explain.
e. Which measure of central tendency would you use if you were a lawyer arguing on behalf of the women employees? Explain.

[5] Queries

1. A function, f, is said to be an *even* function provided $f(x) = f(-x)$ for all x in its domain. A function, g, is said to be an *odd* function provided $g(x) = -g(-x)$ for all x in its domain. What is a geometrical description for even and odd functions? (Complete the sentences "A function is an even function provided its graph is . . . ." and "A function is an odd function provided its graph is . . . .")

2. Is an even function composed with an odd function an even function? An odd function?

[6] Notices

1. Oops—The last Newsletter carried *April* in it heading. It should have been *September*.

2. Past issues of the *Vision - Potential* Newsletter are available on our website: www//ContemporaryCollegeAlgebra.org.

3. Deadline for contributions to the November Newsletter is Monday, November 1, 2004. 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.