Vision - Potential

Vision Within Every Instructor – Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*

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[1] A Report on the "Rethinking Precalculus Workshop"

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The Rethinking Precalculus Workshop, funded by the National Science Foundation (NSF), was held October 4-6, 2001 at the Hilton Crystal City Hotel, Arlington, VA. The purpose of the workshop was to provide participants the opportunity to discuss issues related to "rethinking" the preparation for calculus given that: (1) students are having

* Supported by the National Science Foundation and the U.S. Military Academy.
such different mathematical experiences in high school; (2) calculus in college is placing different expectations on the students; (3) technology is providing an ever wider selection of mathematical tools for both the teaching and learning of mathematics; and (4) college algebra courses are in the process of changing.

The expected outcomes of the workshop included: (1) setting some principles for changing precalculus offerings; (2) providing guidance to the mathematics community to plan and implement changes in courses preparing for calculus; (3) developing a cohesive effort among those individuals who have done groundbreaking work in this area to make a larger impact on the mathematics community; (4) focusing attention on problems/opportunities from NSF and other funding agencies; and (5) publishing of the workshop proceedings as a volume in the MAA Notes series. Fifty-five participants attended the workshop.

The opening address was given by Lynn Steen and was entitled "Twenty Questions about Precalculus." These questions addressed issues such as what exactly is precalculus and the goal of precalculus; who takes or should take precalculus; why is precalculus so often part of general education; when should students take precalculus; where do precalculus students come from and where do they

go; and how should the changing practice of mathematics influence the nature of precalculus? Large group presentations followed. These presentations were entitled "The Status of Calculus" - Deborah Hughes Hallett; "High School Overview" - Zal Usiskin; and "Demographics" - Mercedes McGovern and Steve Dunbar.

Participants were divided into groups based upon their indicated interest in the various themes of the conference. Themes included Precalculus Reform; Student Learning and Research; Changes in College Algebra; Transition from High School to College; Needs of other Disciplines; Technology; Implementation; and Influencing the Mathematical Community. All participants were involved either as presenters, moderators, provocateurs, or recorders. Several participants wrote position papers on the related issues.

A few participants will conduct a panel discussion on various aspects of the workshop at the Joint Mathematics Meetings in San Diego, January 2002.

[2] Small Group Project: Fastball Pitch

Fastball pitches of 94 or more miles per hour were regularly clocked during the past World Series. For this small group, in-class project you are asked to develop both analytical and graphical models for the time (seconds) of a fastball pitch to travel from the pitcher's hand to home plate. Assume that the distance is 60 feet. In particular,

1. Compute the time for the ball to travel from the pitcher's hand to home plate when the velocity of the throw is 95 miles per hour. (Note that velocity is a rate of change.)

2. Sketch a graph by hand of the time (vertical axis) versus velocity (horizontal axis) after first answering the following three questions:

    a. Do you expect the graph is increasing or decreasing? Why?

    b. Do you expect the graph is concave upward or downward? Why?

    c. Does the graph have an asymptote? Explain.

3. Repeat Part 1. for velocities of 80, 90, and 97 miles per hour. If necessary modify your sketch based on these results.

4. Develop an analytical model expressing time (seconds) in terms of velocity.

5. Plot your analytical model.

[3] Consumption Models for Oil

This article was extracted from a talk given by Scott Vaughen, Miami-Dade Community College, at the Gold Coast Meeting of Southeast Section of the Mathematical Association of America in October 2001. The talk, entitled "Calculating the Lifespan of a Non-Renewable Resource," was inspired by Professor Evar D. Nering's article "The Mirage of a Growing Fuel Supply" that appeared in the *New York Times*, June 4, 2001.

Suppose the amount of available oil in the earth is known and suppose the lifespan of this oil will last N years at the present rate of consumption. How does an increase (decrease) in the rate of consumption affect the present lifespan? The following exercises lead the reader to develop consumption models, first for a constant rate of consumption and then for an exponential rate of growth in consumption.

1. Develop a consumption model for oil based on a constant rate of consumption.

    a. Suppose the world-wide supply of oil is being consumed at the rate of 25 billion gallons per year. Suppose also that the present known supply will last for 100 years. What is the present known supply of oil?

b. If the consumption rate is r gallons per year, how long will the present known supply last?

c. Determine a model (function) for the total consumption of oil over t years at a rate of r gallons per year.

2. Develop a consumption model for oil based on an exponential rate of growth in consumption. Assume the rate of consumption during the first year is r gallons per year.

a. If the consumption rate increases 5% per year, determine the rate for the second, third, fourth, and fifth years.

b. Generalize the result of Part a. to determine the consumption rate for the nth year.

c. Determine a model (function) for the total consumption of oil over t years if the rate increases by 5% each year beginning with a rate of r gallons per year. (Hint: express the total as a finite geometric series and then sum the series.)

d. Generalize the result in Part c. to model the total consumption of oil over n years if the consumption rate increases p% per year beginning with a rate of r gallons per year.

3. Compare the two models. The known supply of oil, rt, will last t years at a constant consumption rate of r gallons per year. For how many years will this known supply last if the consumption rate increases p% per year?

a. If the known oil supply is projected to last 100 years at the present rate of consumption, how long will it last if the consumption rate increased by 5% each year?

b. Redo Part a. assuming that enough new oil reserves have been found to project the supply will last 200 years at the present constant rate of consumption.

c. Redo Part a. assuming that enough new oil reserves have been found to project the supply will last 1000 years at the present constant rate of consumption.

d. Redo Part a. assuming that the consumption rate will only increase by 1% per year.

e. Redo part a. assuming that the consumption rate reduces 0.3% per year.

4. The world-wide consumption of oil in 1999 was approximately 1.12 trillion gallons. During the period 1979 to 1999, the average increase in the world-wide consumption of oil was 0.7%. (Source: American Petroleum Institute.) Look up (Internet) the present known oil reserves. Determine how many years this reserve will last assuming the rate of increase in the consumption remains at 0.7%. If new finds double the present known reserve, how many years would the oil last?

[4] A Writing Assignment

Assume the growth rate of a population increases by p% at the end of each period. (The population could be a savings account, fruit flies, apple production, etc. A period could be a month, a day, a season, etc.) Write a two paragraph essay explaining why the growth rate is $(1+p)^{10}$ after 10 periods and why the size of the population will double every $\frac{(log(2)}{log(1+p)}$ periods.

[5] 4th Edition of *Contemporary College Algebra: Data, Functions,Modeling*

This edition will be available from McGraw-Hill (1-800-338-3987) beginning January 1, 2002.

The new edition includes a section on modeling in economics. The section on regression has been rewritten, additional exercises and Fun Projects have been included, and numerous editorial changes have been made. The new subtitle, *Data, Functions, Modeling* is included to call attention to the three major components of the text. Although the final chapter is labeled Modeling, the modeling theme pervades the entire text.

[6] Conversions on a Trip to Canada

Don recently attended the AMATYC meeting in Toronto, Canada. The trip offered him several opportunities to use the college algebra skill of converting from one measuring system to another. The official exchange rate on Friday, November 16, 2001 was \$1 (U.S.) = \$1.5896 (Canadian). Some examples of the opportunities were:

a. The price of gasoline was \$0.67 per liter. How does that translate into dollars per gallon?

b. The Sheraton Centre Hotel in Toronto exchanges 20 dollar U.S. bills for 30 Canadian dollars. Their room charge is \$187 (Canadian) plus a 5% Room tax and a 7% Goods and Services tax. What is the room charge in U.S, funds?

c. At a lunch counter, a five dollar U.S. bill was worth seven Canadian dollars. How does this compare to the official exchange rate?

d. Don bought a sandwich that cost \$3.99 (Canadian) plus 7% tax. He only had a 2 dollar coin, 3 quarters, and 2 pennies in Canadian money. He offered to pay the balance with \$1.00 (U.S.). The clerk was reluctant to accept, but finally agreed in order to keep the serving line moving. Did Don pay enough for his sandwich?

e. In order to simplify the conversion calculations, Don decided to decrease a Canadian charge by a third when paying in U.S. funds and to increase the U.S. charge by a half when paying in Canadian funds? Was this a reasonable algorithm? Explain.

f. What is the official rate of exchange from Canadian to U.S. funds.

g. A speed limit sign stated 80 km/hr. What is the limit in miles per hour?

h. The weather channel reported the temperature was 20 C. What was the temperature in degrees Fahrenheit?

[7] Notices

1. Don Small will participate in the national conference on "Quantitative Literacy: Why Numeracy Matters for Schools and Colleges," sponsored by the National Council on Education and the Disciplines, December 1-2, 2001.

2. The HBCU Consortium for College Algebra Reform will host a national conference on reforming College Algebra, February 7-10, 2002. The Conference will be held at the U.S. Military Academy, West Point, NY.

3. The next issue of the *Vision - Potential* Newsletter will appear in January 2002. The Deadline for contributions to the January Newsletter is Monday, January 7, 2002.

   Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, CBL activites, announcements, and so on are welcomed. Please send material to Dr. Della Bell, Chair, Department of Mathematics, Texas Southern University, 3100 Cleburne St., Houston, TX 77004.

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