Vision - Potential

Vision Within Every Instructor – Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 22, October 1999

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[1] The Fourth Annual Retreat of the Historically Black Colleges and Universities Consortium for College Algebra Reform

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The Fourth Annual Retreat of the Historically Black Colleges and Universities (HBCU) Consortium for College Algebra Reform was held September 30 - October 2, 1999 at Wiley College, Marshall, Texas. The focus of the Retreat was on the use of mathematical modeling to quantify real life situations. Retreat participants were involved in working various problems that required the use of mathematical modeling including (1) determining the Dimensions of a Soda Can; (2) modeling the volume of a pizza box; (3) Pythagoras and Music; (4) "Mercury Rising, Don't Eat the Fish" (pollution in the Hudson River); and (5) a conical cup problem. The graphing calculator was used, whenever appropriate, in solving these problems.

The first College Algebra Fun Project for the Fall Semester 1999 - "City and Country Populations" was discussed. Comments were made regarding the students' response to this project. Several student project reports from Huston-Tillotson College were passed around to participants for their perusal.

Other activities on the agenda included a critique of the first month's activities with the use of the second revision of the Contemporary College Algebra book; and a discussion of the issues related to the next step in the dissemination of the textbook and methodology to schools that are not members of the consortium.

Retreat participants included: Alex Fluellen, Clark-Atlanta University; Joel Williams, Houston Community College Central Campus; Dorothy Hunter, Maryam Fatehi, and General Marshall from Huston-Tillotson College; Eugene Taylor, Grambling State University; Laurette Foster, Prairie View A&M University; Della Bell and Carrington Stewart from Texas Southern University, Sarah Bush, Wiley Col-

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lege; William Echols from Huston Community College System, Northwest Campus; and Don Small, U.S. Military Academy, West Point, New York.

[2] Pythagoras and Music

Pythagoras was a teacher, a philosopher, a mystic, and, to his followers, almost a god. The famous theorem relating the length of the sides to the length of the hypotenuse of a right triangle was named for him. He lived during the $6th$ century B.C. on the island of Samos in the Aegean Sea, in Egypt, in Babylon, and in southern Italy. His thinking about mathematics and life was riddled with numerology. Pythagoroas discovery that the frequency (pitch) of a vibrating string is proportional to its length formed an early basis for tuning string instruments.

When we hear a musical instrument sound a note, we have a general sense of its pitch. For example, we know that the piccolo sounds relatively high frequency notes and the tuba sounds relatively low frequency notes. The names associated with these notes, "A," "C#" and so on are assigned on the basis of their frequencies.

The most widely accepted naming convention for notes, in place since the mid-$19th$ century, uses the following method to assign note names to specific frequencies. The frequency of 440 Hz (hertz) is assigned the note A. You sound this note by striking the $40th$ note from the right end of the piano keyboard counting both black and white keys. (This is also the $49th$ note from the left-hand end of the keyboard.) There are thirteen named notes between 440 Hz and 880 Hz - counting both boundary frequencies. These notes are: A, A#, B, C, C#, D, D#, E, F, F#, G, G#, A - where the symbol # is read "sharp." The ratio of the frequencies of any two successive notes in this sequence is approximately the same. Thus

$$\frac{\text{frequency of C}}{\text{frequency of B}} = \frac{\text{frequency of F}}{\text{frequency of E}}$$

and so on.

Hence if you strike at the $49th$ key on the piano and then strike the next twelve keys in order, you will play the sequence of notes listed previously. The first and last notes in this sequence have the same name - "A." The same naming pattern applies to notes between 880 Hz and 1760 Hz, and so on up and down the range of audible frequencies.

Thus, for any two successive notes with the same name, the frequency of the higher note is twice the frequency of the lower note. The higher frequency note is said to be one octave above the lower frequency note. (When you sing the "do-re-me" scale, the "do" at the beginning and the "do" at the end are one octave apart.) A full-size piano has 88 keys and hence spans a little more than 7 octaves. (Explain?) The highest A note on the piano (third white key from the right end) has a frequency of 3520 Hz.

Problems:

1. Let r denote the ratio of the frequencies of two successive notes. Determine the frequencies of the thirteen keys beginning with the 440 A and ending with the 880 A.

2. What is the name of the $36th$ note, counting from the left-hand end of the piano keyboard? What is the frequency of that note?

3. What is the name of the $24th$ note, counting from the left-hand end of the piano keyboard? What is the frequency of that note?

4. What is the name of the left-most note on the piano keyboard? What is the name of the right-most note on the piano keyboard?

5. The audible frequency range is between 20 Hz and 20,000 Hz. What is the the lowest audible note? What is the highest audible

note? How many octaves are included in the audible range?

[3] "Oh, For those Good Old Days"

Several States over the past few years have established passing levels on State tests that must be met in order for a student to graduate from high school or to enter their third year of college. These legislative mandates have caused a bit of controversy and, at times, wishes for returning to the policies of the "old days." Were college entrance tests really easier in the "good old days?" Consider the following (Mathematics) Entrance Examination to the U.S. Military Academy that was administered in 1896.

Division I

1. Express 1666 by the Roman system of notation.
2. Multiply four million twenty five thousand and one by one hundred thousand and twenty.
3. What are the prime factors of 2772?
4. Find the least common multiple for the numbers 270, 189, 297, 243.
5. Divide $\dfrac{3\frac{1}{4} - \frac{0.45}{\frac{5}{6}}}{\frac{7}{9} + \frac{11}{8}}$ by $\dfrac{(1.05)(2\frac{1}{3})}{\frac{5}{62} + 0.3}$
6. Change 0.4 to an equivalent fraction whose denominator is 28.
7. Reduce 3 mi., 8 fur., 15 rds., 4 yds., 2 ft., 7 in. to rods.
8. A railroad has three tracks of the following lengths: 3013, 2231, and 2047 feet. What is the length of the longest rail that will exactly lay each track?
9. If $37\frac{4}{5}$ yards of cloth 4 feet wide cost \$4.25, what will $104\frac{1}{7}$ feet $1\frac{1}{2}$ yards wide cost at $\frac{4}{5}$ the price?
10. A and B together can do a piece of work in $15\frac{1}{2}$ days. A can do $\frac{3}{5}$ as much as B. In how many days can each do it alone?

Division II

1. Give the rule for reducing two or more fractions to their least common denominator.
2. What is the effect of dividing the denominator of a fraction by a whole number, and Why?
3. Give the rule for changing a decimal to an equivalent common fraction.
4. Give the rule for dividing one decimal by another.
5. Give the rule for reducing a decimal of a given denominator to integers of lower denominations.

The candidate will state the text books in this subject that he has studied, and write his number in a legible hand.

Note: Time allotted for this examination was four hours. Sixty-six percent was required for admission.

"Oh, For those Good Old Days"

[4] Small Group In-Class Activity: Which is Larger or are They the Same?

Make a paper cylinder by rolling a long side of an eight and one-half by eleven sheet of paper onto the other long side. Make a second cylinder by rolling a short side of an eight and one-half by eleven sheet of paper onto the other short side. Without measuring or computing, answer the following and prepare to explain your reasoning to the class.

a. Are the volumes of the two cylinders the same?

b. If the volumes are different, which cylinder has the larger volume?

Compute the volumes of the two cylinders. Do your computations agree with your original insight? Reflect on the relationships between the volume of a cylinder and the radius and height of the cylinder. For example, would a tall thin cylinder have the same volume as a short fat cylinder when both have the same lateral surface area? (The lateral surface area does not include the area of the top and bottom.)

Suppose the lateral surface area of a cylinder is 93.5 square inches (the area of a eight and one-half by eleven sheet of paper). Express the height of the cylinder as a function of the radius of the cylinder. Express the volume of the cylinder as a function of the radius by substituting for the height in the volume equation of a cylinder. Considering your function of volume in terms of the radius, what can you say about maximizing the volume?

[5] Notices

1. The AMATYC 25^{th} Annual Meeting will be held in Pittsburgh, PA, November 18-21, 1999. Jackie Giles and Don Small will present a 4 hr. workshop: "Contemporary College Algebra: A Reformed Program."

2. The next issue of *Vision-Potential* Newsletter will appear in November. The Deadline for contributions to the November Newsletter is

   Monday, November 8, 1999

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

3. The Contemporary College Algebra "Team" will be strongly represented at the National Mathematics Meetings in January in Washington, DC.

   a. Della Bell, Ahmad Kamalvand, and Don Small will host a six hour contributed paper session: "Interdisciplinary Applications in College Algebra." (Wed. 2:15-6:00 PM; Thur. 1:00-3:45 PM)

   b. Laurette Foster will be a presenter in Minicourse 10: "Interdisciplinary Lively Applications Projects." (Thur. 8:00-10:00 AM; Sat. 9:00-10:00 PM)

   c. Laurette Foster will be a panelist on the panel "Changing the Academic Culture." (Fri. 1:00-2:20 PM)

   d. Our team will host an "MAA Open Discussion on College Algebra Reform" (Sat. 1:00-3:00 PM)

4. To subscribe to this Newsletter, send your name and address to Dr. Della Bell, Department of Mathematics, Texas Southern University, 3100 Cleburne St.,Houston, TX. 77004

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Baseball's homerun king, Mark McGuire, was recently quoted in an ESPN interview, "I played the first five years of my baseball career on physical ability alone, and I wasn't too shabby. Then I realized how you can use your mind in this game, and now I am a firm believer that 95% of this game is mental." Mark McGuire is not alone in recognizing the role of mental preparation in success in any field. The distinguishing feature that separates the best performers (in any field) from those who have the necessary skills is the ability to use the mind effectively. Engaging in challenging problem solving that includes making and testing assumptions, generalizing results, and conjecturing into the unknown has long been accepted as a primary way for developing mental capabilities.