MPI

The Mathematics and Physics Institute NEWSLETTER

Director: Richard Waring
Mathematics Coordinator: Richard Delaware

October 1, 1988 Vol. 3, No. 2

BEGINNING, AND BUSING BLUES

We too were affected by the woes of the Kansas City, Mo. District beginning bus schedules, since 19 (33%) of our students are from this district; but all at last seems resolved as we finally begin to settle into a working rhythm here at the MPI.

Currently, 58 students are enrolled from: East (5),Fort Osage (12), Northeast (9), Truman (10), Van Horn (5), and Wm Chrisman (17) High Schools; 16 (28%) are women, and 14 (24%) are minorities.

BBQ AND HAYRIDE
SATURDAY, OCT. 8, 1988

In order to encourage a comradery among our students that often doesn't gel until later in the year, on Saturday Oct. 8, 1988 from 5-9 pm, Richard Waring will host our first MPI barbeque and hayride at his home in Liberty. All students will be responsible for their own transportation, but food and hay will be donated by the MPI staff.

MPI OPEN HOUSE

SUNDAY, NOV. 6, 1988, 2-4 PM

Sunday Nov. 6, from 2-4 pm, the MPI will hold its annual OPEN HOUSE for parents, teachers, counselors, administrators, and anyone else interested in talking to the faculty, staff or students of the Institute.

We'll be in the Truman Campus Building of UMKC behind the Truman Library just North off Hwy 24 in Independence. We plan to have several rooms organized with physics demonstrations and laboratory equipment, mathematics demonstration problems on chalkboards, and videotapes of recent problem-solving sessions and past enrichment speakers. In Room 102 at 2:30 pm, there will be some brief remarks by the MPI director and the introduction of the MPI teachers, followed by a 10-minute slide-tape presentation, and of course, refreshments (!), all staffed by this year's students and faculty. If you have questions, please call 276-1272. We invite you all and look forward to seeing you on:

SUNDAY, NOV. 6, 1988
2-4 PM

ENRICHMENTS

Our study skills special enrichments for Note-taking and Textbook Reading on Sept. 14, and Time Management and Test-taking on Sept. 21 were once again well-received by our students:

- Covered everything I wanted to know.
- I wish all teachers would tell students about textbooks and give hints and pointers to "do well".
- My entire high school career has been cramming and I realize now that I need to change.
- I liked the idea of going over a problem just before the test to get your mind working.

- I liked the handouts and the "time plan" worksheet. It'll be easier to get with the program with an actual schedule.

- If anyone needs to know how to manage...time, it's yours truly.

On Sept. 28, Dr. Wai-Yim Ching of UMKC's Physics Dept. spoke to us about the current research in Superconductors. Dr. Ching neatly delineated their history since the discovery of the phenomenon in 1911, through the unexpected discoveries of late 1986, up to the newest (1988) materials which become superconducting at the unheard-of high temperature of 125 degrees Kelvin! (Room temperature is about 300 K.) Afterward, we crowded round at close range to see the by now famous demonstration of a tiny magnet floating in mid-air (the Meissner Effect) over a quarter-sized cake of superconducting ceramic submerged in liquid nitrogen.

UPCOMING ENRICHMENTS:

On Oct. 12, Mike Carter from the Rockhurst Dept. of Mathematics & Computer Science will discuss Understanding AI (Artificial Intelligence) and Expert Systems.

On Oct. 26, Sam Gill will speak for two hours on Unsolved Mysteries and Extraordinary Phenomena, the title of the course he teaches at Johnson County Community College, and a subject he has lectured to many groups about, hoping to probe our students' beliefs in all sorts of pseudoscientific claims, quackery, the paranormal, etc. and demonstrating to them how simple logic demolishes many such statements, while the rules of sufficient evidence can eliminate most of the others. The talk promises to be an exciting lesson in rational thought.

Our annual field trip to the University of Missouri Research Reactor and tour through the Physics Dept. to view current research will be held all day on Nov. 9.

Finally, on Tues. Nov. 22, we will once more be very pleased to have Dr. Henry Mitchell from UMKC return with his popular lecture: The Bat: Strange Creature of the Night. Being an internationally respected authority on bats, as well as an entertaining speaker, Dr. Mitchell is always received enthusiastically. In fact, he is the ONLY speaker to have spoken at the MPI all five years.

THE MPI TEACHING LOG

Every calculus text begins with a review of basic algebra, analytic geometry and trigonometry to try to raise the widely differing skills of any class to more or less the same level. One of the assignments used during this portion of MPI calculus courses is called "Lapses in Mathematical Reasoning" and consists of scrutinizing a series of algebraic derivations or 'proofs' of obviously false statements. For instance, a student will be faced with 'proofs' that any two real numbers are equal, that positive numbers are negative, that 0 = 1, etc., and will be asked to discover the mistake, identify its cause, and correct it. Such exercises both allow algebraic skills to be painlessly reviewed, and train students to be alert to common, but often hidden errors that can creep into their own work. The problems generate much frustration and discussion, but students seem in the end to be enlightened.

BROTHERS AND SISTERS

Here, as a curiosity, is a chart of the sets of siblings who have attended the MPI over the years from 84-85 to the present:

Year 1	Year 2	Year 3	Year 4	Year 5
	Rolando Aguilera	Maria Aguilera		Anthony Aguilera
	Eric Baker		Ryan Baker	
Jody Breshears		Suzanne Breshears		
	Trang Du			Hang Du
	Gladys & Glynda Gilford			
	Phil Kelsay			Brian Kelsay
				Andrea & Audrey Linville
Sheryl Nance			Kelly Nance	
			Duc & Chi Tran	
	Van Tran		Hien Tran	

CORRECTIONS to the MPI CALENDAR -- 1988-89

(Note: We are finishing ONE WEEK EARLIER than previously printed. Only the following dates are affected.)

Final Exams -- Calculus I (A,B,D) Calculus II (Math C only)	May 16, 1989
Final Exam -- Physics (A,B,C,D)	May 17, 1989
MPI Picnic Breakfast (McCoy Park)	May 18, 1989
MPI Awards Presentation (UMKC Truman Campus)	May 19, 1989
Last Day of Institute Classes & Quarter 4/ Semester 2 Grade Reports Sent	May 19, 1989

A BASQUE STUDENT

Foreign exchange students from Germany, South Africa, and Turkey have all attended the MPI in previous years and now we are pleased to extend our hospitality to a student from the unusual Basque region of northern Spain. There the fiercely independent Basque people live in a tiny area sundered by the Franco-Spanish border, speaking the unique Basque language, which is apparently unrelated to ANY known language.

Enrolled in Fort Osage High School this year and taking calculus at the MPI is Ainhitze Bravo. She is from Bizkaia province in Spain, lives in the Basque city of Bilbao, where her father works for a West German computer company, and she speaks Spanish, English, and of course, Basque. She is interested in law and in becoming a diplomat so that she might eventually work toward complete independence for the Basque nation.

Incidentally, MPI translates into Basque as:

"Matematika eta Fisika Ikastegia".

SOME STUDENT QUOTES, 1988-89

" In the beginning the MPI program was bizarre and frightening. We received a list of 'Minimum Suggested Homework' as long as the list of convicted criminals in the Reagan administration. Fortunately, we are given plenty of time to complete these problems. The instructors are great, but the books are too heavy. Now that things have settled down, and I have become used to getting up at 6:00 in the dark hours of the morning, everything is OK. I'm looking forward to an interesting year."

Sean Combs
Fort Osage High School
Fort Osage District

" I believe that attending the Institute will broaden my education and prepare me for college. I am learning what college will be like and finding out what will be expected of me. This is the just the beginning, but I feel that it will be a very positive learning experience, and something that will stay with me for years to come."

Rachel Mack
Truman High School
Independence School District

" My reason for going to the MPI is to further enhance my knowledge of math and science. By taking these courses I will have some background on the subjects so when I do go to college I won't be completely stunned. The only thing I dislike about the program is having to get up so early to get there."

Marc Compton
East High School
Kansas City, MO District

A SOLUTION TO MATHEMATICS CHALLENGE #6

If A and B are integers, when will the expression

$$\frac{A}{B} + \frac{B}{A}$$

also be an integer?

SOLUTION:

We begin by supposing that

$$\frac{A}{B} + \frac{B}{A} = K ,$$

where K is assumed to be an integer. In this sort of argument, either we will discover which integers K can be, or, that the assumption that K is an integer leads to a contradiction, meaning our expression can NEVER be an integer.

First note that neither A nor B can be 0, since division by zero is undefined. Also, immediately cancel any factors common to A and B (i.e., force A and B to be 'relatively prime'.) Then, combining fractions on the left and cross-multiplying gives:

$$A^2 + B^2 = ABK$$

$$B^2 = ABK - A^2$$

$$B^2 = A(BK - A) .$$

Since A is an integer and A divides the right side, it must divide the left side, i.e., B^2, which, since A and B are relatively prime, can only happen if A divides B itself. Since the above argument is symmetric in A and B, we can likewise conclude that B divides A.

Hence, the only way our original expression can be an integer is when $A = \pm B$ (and of course, neither is equal to 0.) This answers the question of the challenge, and incidentally forces K to be ± 2.

MATHEMATICS CHALLENGE #7

If there are more trees than there are leaves on any one tree, then there exist at least two trees with the same number of leaves. True or False ?

Editor/Writer: Richard Delaware

The MPI Newsletter is published five times a year on the first of the month during the months of August, October, December, February, and April at The Mathematics and Physics Institute, 600 W. Mechanic, Independence, Mo. 64050, phone (816) 276-1272. Please address all correspondence concerning this newsletter to 'MPI Newsletter'.