Mπ

The Mathematics and Physics Institute **NEWSLETTER**

Director: Richard Waring
Mathematics Coordinator: Richard Delaware

April 1, 1992

Vol. 6, No. 5

AS YEAR 8 ENDS

This year we created a new MPI brochure for the '90's, fielded an excellent TEAMS contest team, and most importantly, used a computer laboratory in a regular and essential way in all sections of calculus. It is too early to tell whether on balance mathematics software has made calculus any more memorable for our students. But we are committed to making our courses fresh, engaging, and aligned with the national endeavor towards improved science and mathematics education. A carefully integrated computer laboratory component ideally opens doors to a more robust understanding.

While our 1991-92 MPI class of students are beginning their college careers in the fall, the MPI will face new challenges. During the next two years, three of our five participating high school teachers will retire, so we must search out others of comparable talent and enthusiasm to fill the void. Secondly, we hope to find funding for our own PC Lab next year, so that our experiment can continue.

We thank all of you who support us.

TEAMS TEST TEAM 1992
- THIRD PLACE! -

For the first time in four years the MPI has won a team award. Our 1991-92 TEAMS contest team was awarded a 3rd place plaque in the Large/Selective School Division. [Oak Park High School won 1st, and North Kansas City High School won 2nd.]

We are very proud of our team:

Gary Cauthon	Scott Hummel
Laura Dilley	Mark Matson
Chris Gross	Jeff Schreiner
Pat Hayden	Sonya Smith

MATHEMATICS AWARENESS WEEK 1992

April 27 - May 1

The theme of national Mathematics Awareness Week this year is "Mathematics and the Environment". For a second year the MPI will celebrate this theme by sending out seven teams of 3 students each to make 30 minute mathematics presentations to 8th grade students at 5 local middle schools and junior highs. Last year's first attempt was enthusiastically received by both teachers and students. The presentation will include illustrations of the use of mathematics in a wide variety of careers, advice on what courses to take in high school, and various stickers and pamphlets will be distributed. Once again we hope to entertain and perhaps inspire some young students while giving our own MPI students a chance to share what they know.

CALCULUS READINESS EXAMS

During the week of May 4 the Mathematics Coordinator will travel to each of the six high schools participating in the MPI to administer the MAA Calculus Readiness Test, a 25 question diagnostic test designed to roughly determine how prepared a student is to take calculus. It covers analytic geometry, algebra, and some trigonometry. A score of 12 or above is required to attend the MPI,

although occasionally lower scores are accepted provided a transcript and two recommendations are received, and an interview with the Director takes place.

Of course, this little test is by no means definitive, and in fact, a student's commitment more often determines his or her success at the MPI than a score on one introductory test. However, this test has proved to be effective as long as it is complemented by careful screening done at individual high schools by counselors and teachers who know the students in question.

We hope to see some of you soon!

CALCULUS LABS REPORT

To help our students prepare for our calculus final and consolidate what they've learned over the year, after lectures are done we will present them with a set of somewhat unstructured problems. These will definitely require calculus, and may be solved with or without the use of Derive on the computers. This, we hope, will test their true command of the subject, and whether they can decide when computer use is appropriate, as well as help us refine our teaching.

PROFILES IN SUCCESS

KIM (GALLAGHER) BROX was a member of the 1986-87 class at the MPI. After graduation she attended Benedictine College in Atchison, Kansas for 2½ years before transferring to Iowa State University, where she completed her Bachelor of Science degree with a major in History.

Kim tied the knot in June, 1991 and now resides with her husband in Lawrence, Kansas. She has a management position with the Department of Housing and Urban Development and does some substitute teaching. Kim hopes to become a high school teacher and is currently working on her certification with specialties in Mathematics, Chemistry and Biology. Best wishes for continued success.

THONGVAN THI TRAN was one of our quiet and hard working Vietnamese students. She finished the MPI program in 1986 and received a Scholars Award to attend UMKC. In 1990 she received a rare double degree; a B.S. with a major in Biology and a B.A. with a major in Chemistry. She was accepted in Medical School at UMC in the fall of 1990, and will complete her Basic Science Curriculum this spring and enter clinical training where she must complete a required rotation in all areas of medicine. "Van" says she likes medical school because it is interesting and challenging, but admits a lot of hard work and persistence is required.

Keep up the good work Van and in a couple of years it will all pay off in some big dollars.

Richard Waring

ENRICHMENTS

FOLLOW UP

When Dr. David Frayer spoke on Jan. 31 about our ancestors the australopithecines, he brought with him a cast of the famous Laetoli footprints found by Mary Leakey, and injected some elementary physics by discussing bipedal locomotion in terms of a compound pendulum. His visits continue to be high points.

Our first field trip on March 13 to the Kansas City Museum, with its new emphasis on science, went

well. Some student comments were:

--The field trip was excellent. It was so interesting and fascinating about some of the facts on the walls. I like the hands-on part of it. Usually when you go to a museum they say "hands-off, don't touch", but this was really neat.

--We were able to experience an earthquake, build a city and see how it stood (in a flood), see how plates in an earth- quake moved, make a perfect wave.

Since this issue of the newsletter is a bit late we are able to report on our enrichment speaker of April 3. He was Brent Harding, an engineering specialist in the Engineering Services Division of McDonnell-Douglas Space Systems Co., in Houston, Texas. Brent is also the first MPI Alumnus (1984-85, our first year!) to return as a speaker. The title of his talk was EXPERIENCES IN THE SPACE PROGRAM AT McDONNELL-DOUGLAS: PAST, PRESENT, AND FUTURE.

Brent has worked on Space Shuttle problems for NASA, the Space Station Freedom Guidance system (including Reboost, Collision Avoidance, and Crew Displays), and is now working in Space Shuttle Entry Navigation (including inertial measurement units, TACAN, etc.). He reported that NASA is preparing to install the GPS (Global Positioning System) into the Shuttle. This satellite system was extremely successful during Desert Storm, allowing soldiers in the desert to precisely locate themselves, and it is now being marketed commercially for the rest of us.

UPCOMING

On May 1, Civil Engineer Shelley Wolff will return to discuss HIGHWAY SLOPE DESIGN following our week-long work on similar problems.

Sun. May 3 we will make our annual trek to Worlds-of-Fun Amusement Park, where our students will spend several hours working out physics problems keyed to various rides. As usual, we buy the tickets, and their time when finished with the work is their own.

May 13 we'll hold our annual Picnic/Breakfast at McCoy Park, and finally, on May 14, we'll have our Awards Presentation in "The Loft".

PAST STUDENTS WRITE TO US

IVAN BIRD (89-90)
(Civil Engineering Major)

"It has allowed me to get certain classes behind me and 'extra practice' in physics. I will now graduate from college in three years.

Encourage more students to participate and make every effort to encourage them to do well. Some students treat the MPI as a social gathering. It's not. Some people end up taking calculus over again in college. Why did they even come to MPI? Try to make it serious--but interesting. If students are getting down on MPI, remind them of the Spring-picnic-in-the-park!"

KENDRA VANTUYL (90-91)
(Major Undecided)

"PACE YOURSELF → you can't do all the work the night before the test.

I learned to look at each problem objectively with an open mind.

I learned more personal responsibility and more importantly, I learned how to FAIL!"

JENNIFER SPUNGEN (90-91)
(Major Undecided)

"Learned to study for a test more than the night before it and I learned how to manage my time well.

I learned to correct myself to get what I want and to make my point clear.

I met so many new and different people."

STEPHANIE REYNOLDS (89-90)
(Major Undecided)

"Since I plan to take on a career in the medical field, I regret not having taken the physics course at MPI, where I know I would have received better instruction. As for calculus, it was a great preparation for college, teaching valuable study skills. (I wish I could do something like MPI again. Now, I think I would appreciate it more and, therefore, take it more seriously.)"

MARK LAMBROS (89-90)
(Major Undecided)

"I feel it helped me tremendously my first semester in college. I was able to understand how my study habits needed to change.

Anyone who can should take it. It was the biggest learning experience of my high school career."

SUZANNE BRESHEARS (86-87)
(B.S. Biology; Graduate student in Marriage & Family Therapy)

"Hello there. I'm doing well. I've decided (finally) to change career course. I'm heading into Marriage & Family Therapy (get me out of the 9-5 work world. Yuck!) Even though I'm heading for a "soft science" field, I feel MPI was extremely valuable in helping me train my mind to think logically and solve problems. I highly recommend it to anyone who loves a challenge. Hope all is going well for all of you. I think of you often."

THUY PHAN (89-90)
(Architecture Major)

"Definitely the instruction in the MPI courses are better because right now I am taking a structure course that deals with physics problems, such as equilibrium where $\Sigma F_x = 0$, $\Sigma F_y = 0$, and $\Sigma M = 0$. Three-fourths of the class does not understand what the instructor is talking about. Luckily I do, thanks to the MPI courses that I took. The instructor that I have now always cuts corners when he works on a problem. This is why the students don't understand what he's talking about. Not like the instructors at MPI, where they go step by step.

I am aware of all the things that (are) going on around me and to plan my future career more carefully and to take things one at a time, just like solving a problem, you got to work step by step, and know what you are doing."

SHALOM BARBER (90-91)
(Major Undecided)

"Being involved in MPI has showed me that I can achieve in things that are "hard", and taught me how to study with others and to prosper from the studying.

The MPI staff is very understanding and open when someone has a question. Everything from labs to enrichments to lectures to TEAMS test was enjoyable and has helped me this year when I was exposed to "real college life"."

JON MORGAN (88-89)
(Performance Major-Voice)

"Even though I'm a voice major, It really helps having been exposed to physics. I even got the chance to give the lecture on the Physics of Sound at MPI. Since then I have worked in the Otto B. Schoepfle Vocal Arts Laboratory with an engineer and a prominent vocal Pedagog. My experience at MPI helped tremendously. It was actually the reason I got the job. In the laboratory they use a "Kay" machine to separate the singing voice into its partials (harmonics). We're beginning to be able to identify certain vocal problems by what we see. Very Exciting."

HEMABEN PATEL (89-90)
(Major Undecided)

"Taking calculus there (at the MPI) is a real help now. I still remember some of the things we did and how we did it. If there were things I didn't know how to do then, they make sense now. I know how to work the problems faster and easier. The MPI helped a lot in that.

The MPI really prepared students for college. I probably didn't see it that way when I was there then, but I know now that it does. Anyone who has the chance to take up such an opportunity like the MPI shouldn't miss out. It only comes once. That's why I regret now that only if I worked a little harder I wouldn't have to take calculus and physics again!"

JEFF THATE (89-90)
(Mechanical Engineering Major)

"I'm really concerned with the news that the engineering department at UMKC will be closed and what that might mean for MPI's future. Hopefully this won't cause a problem; and if it does-the school boards can find some way to keep MPI, because it truly is one of the few educational programs that exist that can really make an impact on future education and success in general."

ERIC BUTKOVICH (86-87)
(B.A. Political Science-Soviet Studies; now in law school)

"One of the wisest decisions of my entire life was to attend MPI. The quality and quantity of work prepared us well for college. I am constantly amazed at how important and relevant the study of physics can be. Even in politics and law, the concepts of force, momentum, mass, velocity, friction, and acceleration are used on an almost daily basis. A background in physics is helpful in understanding political power and its applications. I will always highly recommend MPI to all high school students and to everyone else as well."

NIKKI ELKINS (90-91)
(Major Undecided)

"Before MPI, I did everything on my own. Problem solving sessions cured that.

Before MPI, when I was given a challenging problem (the questions in the book w/little stars by them), I would just assume I couldn't do it. The difficulty of the problems at MPI helped me believe I could do them.

Thanks!"

FINAL 1991-92 STUDENT IMPRESSIONS

"I really enjoyed taking the calculus and physics classes at MPI this year. I think it was very challenging. I learned that in order to prepare yourself for college, you really need to study hard, do the homework, use your time wisely and never give up. To all students who

are preparing for college, you should try MPI, it is worth it."

LaTonya Slaughter
Northeast High School
Kansas City School District

"Going to college is tough. What MPI does to you is prepare you for college. MPI has been a challenge for me and it made me and other students more competitive, my advice is keep up with the problems given to you and review the lectures."

Roman Puno
Van Horn High School
Kansas City School District

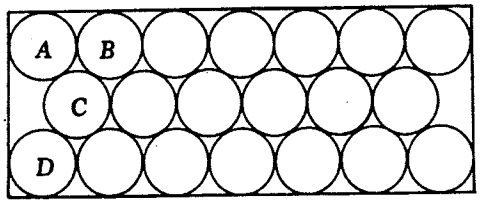
"One thing MPI has taught me is that studying is very important. The most important part is being there for the lectures. If you miss out on the lectures make sure you catch up. Most important of all do not fall asleep in class."

Veronica Hooker
Northeast High School
Kansas City School District

A SOLUTION TO MATHEMATICS CHALLENGE #22

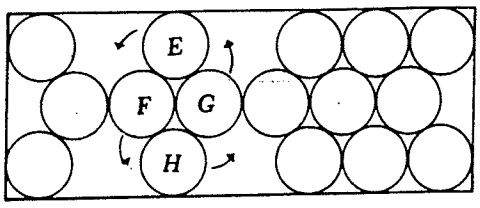
Recall the problem statement:

A man was looking at a full package of cigarettes from which he had torn the end,



and wondered how many could be removed WITHOUT LOOSENING any others. So, he tried rearranging them.

Obviously if C was missing, A could slide down, and D up. Or, if A was missing, C could slide out from between B and D. But, the removal of B left things firm. He soon also found out that the arrangement below was no good



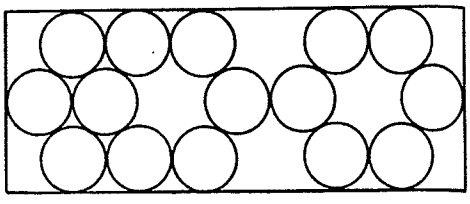
because the group EFGH could rotate as a whole.

He was never able to pack in less than 15 firmly, but he did find an arrangement with 5 cigarettes in each of the three rows. What was this arrangement?

[From: Mathematical Brain Benders, 2nd Miscellany of Puzzles, by Stephen Barr]

SOLUTION:

The important clue in the problem statement is the word "REARRANGING". By putting a seven-space row in the middle, there is room for only nineteen cigarettes, four of which can be removed, leaving 5 cigarettes in each of the three rows, for a total of 15 as in the figure below.



A SOLUTION TO PHYSICS CHALLENGE #13

Recall the problem statement:

Should you hit a hardball and a softball differently? In particular, should there be more follow-through for one than for the other?

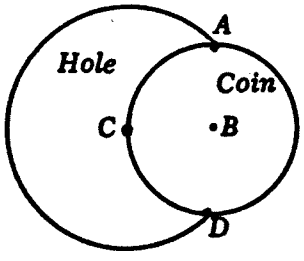
SOLUTION:

The softer the ball, the longer it will be in contact with the bat, and the more work the batter can do on the ball during that contact. Thus, follow-through should definitely be used on a softball.

[From: The Flying Circus of Physics by Jearl Walker]

MATHEMATICS CHALLENGE #23

A coin collector had a table with an exactly circular hole in it, where long ago had been an inkwell. He had two pure gold coins of the same thickness; the larger one exactly fitted the hole, and the smaller one, when slid gradually over the hole, tipped into it when its edge reached the center of the hole. (See figure below.) If the larger coin weighed 6 oz., what was the weight of the smaller coin?



[From: Mathematical Brain Benders by Stephen Barr]

PHYSICS CHALLENGE #14

DON'T ROCK THE BOAT

Suppose you are in a rowboat in a small swimming pool. In the boat is a large rock. If you drop the rock into the pool, does the water level rise or drop?

! NOTICE !

The August 1 newsletter will list the top ten MPI students for 91-92 and all those receiving awards at our May 14 Awards Presentation.

There will also be IMPORTANT INFORMATION and advice for the class of 92-93. TAKE NOTE!

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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) 235-1272. Please address all correspondence concerning this newsletter to 'MPI Newsletter'.