

Director: Richard Waring
Mathematics Coordinator: Richard Delaware

December 1, 1996

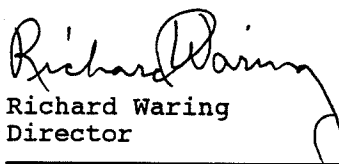
Vol. 11, No. 3

OPEN HOUSE THANK-YOU

Eighty-three individuals attended our 12th annual Open House on Nov. 3. Included were 48 parents and relatives of MPI students, 1 alumnus, 2 school administrators, 32 students, and the entire MPI faculty and staff. This was one of the best turnouts in our 13 year history. I want to thank all of you for taking time from your busy schedules to see what is going on at the MPI. Your attendance demonstrated to your son or daughter a genuine interest in their activities and education. Your support has helped mold their priorities and goals. You have probably found that the demands and expectations at the MPI may be a new experience for your son or daughter. Your continued help, support and encouragement will contribute immensely to their success.

Although we believe everyone should have a solid basic understanding of mathematics and his/her physical environment, the study habits, reasoning ability and problem solving skills developed at the MPI are our highest priority, since these qualities carry over to other disciplines, and are essential in every productive individual. As we move, more and more, to a world economy, a solid education with well developed reasoning and problem solving skills is becoming a necessity.

Should questions about the MPI arise, please feel free to call.


Richard Waring
Director

TO ALL MPI ALUMNI:

HAVE YOU GRADUATED FROM COLLEGE?

IF SO:

PLEASE CONSIDER BEING
AN ENRICHMENT SPEAKER

OR JOINING OUR

PANEL DISCUSSION!

[Fri. Jan 3, 1997]

CALL (816) 235-1272

MATHEMATICS TECHNOLOGY REPORT

1. This month we learned that SHARP will be announcing around April a new model (after 3 years!) of the EL-9300C graphics calculator which the MPI currently requires all students to use. So, we will wait to see how the new model improves upon the old, before we decide whether to switch to the HP 38G or this new SHARP.

2. Also, Derive for Windows has finally been released and is a wonderful upgrade to "classic" Derive (for DOS). Its only drawback for us is that it requires 8 MB of RAM to run, and all but ONE of our student lab computers have only 4 MB of RAM. And as is true for most Windows programs these days, it runs best on a 486 machine or better, of which we are also in short supply. Luckily "classic" Derive fulfills our needs for the moment.

ODDS AND ENDS

On Nov. 27 we sent out our annual letter to the parents of current MPI students, containing suggestions on what graphics

calculators or mathematics software might make meaningful Christmas gifts.

From Jan. 4-8, Larry Harding and Richard Waring will attend the annual AAPT (American Association of Physics Teachers) conference in Phoenix, AZ.

ENRICHMENTS

FOLLOW UP

Oct. 11, Seth McMenemy (MPI 88-89) an electrical engineer with Kansas City Power and Light, working as a distribution engineer, spoke to our students on **ELECTRICITY: POWER, TECHNOLOGY, AND ENGINEERING.**

Some student comments were:

--I loved the candy! Every speaker should adopt this tactic. I also liked the variety of areas that he covered. The future uses of electricity were very interesting. He seemed very knowledgeable about this subject area.

--The speaker changed our view on electricity from a vague understanding of "power" to a better comprehension of electricity as a force with substance and properties. We learned how the electric company harnesses electricity using generators, wires, and transformers, and what happens as electricity travels to your house.

--He discussed how electricity worked. He showed us how they repair electric cables and about magnetic fields. He also taught us several facts and how our MPI classes will help us in being an electrical engineer.

On Oct 25, John Renner, MD of the Consumer Health Information Research Institute and on the board of the National Council Against Health Fraud spoke on **HEALTH, MISINFORMATION, AND JUNK SCIENCE: HOW TO EVALUATE IT.**

Students commented:

--The media many times write bizarre interpretations of scientific information... don't always check credentials before interviewing doctors and scientists.

--He talked about all of the medical fraud there is in America, and how easy it is to fool the American public when their emotions are involved. He also talked about how the media's interpretation of a situation versus reality are sometimes the exact opposite. Dr. Renner basically was trying to teach us how to think critically and not believe everything you hear. Question everything and check the validity of all people and sources. Dr. Renner's talk was interesting and enjoyable.

--Many doctors are getting incorrect information about different types of treatment and medications. I really enjoyed Dr. Renner's talk. It was a very "enriching" experience! I had no idea so many fraudulent things exist on the market.

--The uneducated U.S. Public blindly believe everything we read or see on television, no matter how scientifically incorrect or correct the studies were. Consequently, the public will stop buying products just because the newest Dateline show said it was harmful. Some examples include an anti-aging agent that is used on apples which lead to a decrease in apple sales, and a reduction in use of breast implants because of faulty studies. We practiced asking analytical questions for theoretical questions. We were also able to see many products that are scientifically flawed but still widely used. He was very interesting and his topic was very pertinent to today's society.

--He described all of the different types of junk science and really surprised me at how much there was. He talked about how many things are assumed and not actually proven. Information on breast implants, Gulf War Syndrome, the Times Beach evacuation, and Bendictin all have flimsy scientific facts.

--Dr. Renner educated us about the dangers of health care fraud. He told us how to spot it by thinking critically. He told us several questions we should ask ourselves when buying any product to avoid being cheated. His visual aids were interesting and effective. He warned us to become educated about health care products especially because they could be harmful to our bodies. He had many true stories/facts to back

up his opinions, and easily held our attention.

--He explained the fallacies behind some of the more famous myths. He also provided us with a base of knowledge for evaluating sources of scientific and/or medical information. I would be interested in watching Dr. Renner debate w/one of the "quack doctors," but that would be tough to squeeze in one hour.

--He showed us several drugs which really don't do what they say they do. The growing mushroom for example. He then showed us the trick some doctors use to get patients to believe they are allergic to a product. He also told about a radio station interviewing a woman from prison about a product which was the reason why she was there! I think this was the most interesting enrichment we've had this year. Dr. Renner did an excellent job of presenting the material and getting his point across. I had never really before thought about how much out there was being presented to the common people and it's all just a gimmick to gain money. He really kept my attention though. But the growing mushroom in that jar was disgusting.

Ron Schuchard, Professor of Ophthalmology and Physics at UMKC, joined us on Nov. 8 to speak on **VISUAL INFORMATION PROCESSING: HOW DOES THE BRAIN SEE?**

Students responded:

--He told us about how the rods and cones affect either night (black-white) vision or color vision and the types of cones. He explained rainbows and sunsets, what is necessary for both and what we are really seeing and why. I thought the illusions and the explanations were VERY neat ☺. I enjoyed him and learned a lot I hadn't ever thought about before.

--He told us that medical physicists are involved in radiation therapy, MRI's, CT scans, and other medical procedures. You are able to see because light goes into your eyes, then back to your brain. The brain then processes this information. Rainbows are most apparent when you look at the sky after a rain, with the sun shining on the back of your

head. The sunlight is reflected off of the raindrops, which break up the light into the various colors of the spectrum. Mr. Schuchard did a good job presenting this information to us. I especially liked the information he gave to us about the various types of vision problems he has encountered in his career. Many of them amazed me since I did not even know that they existed.

--I especially liked the fact that the speaker used visual aids. He kept me interested in what he had to say. He was the best enrichment speaker I have heard since I have been in MPI.

--He explained how sunsets are orange, red, and pink and showed us a "fake" sunset with milk in water in front of the slide projector light. He also told us about how the brain allows for the blind spot in the back of the eye and how it (the brain) sometimes misinterprets the information it sees, like the words "me" and "an" are read as "mean."

--He had us stare at a black, green and yellow flag, then look at a piece of white paper. When we look at the paper we see a red, white and blue flag. Our brain filters out the yellow, green, and black colors. He presented slides that had hidden images. Once you saw them it seemed really easy.

--The interesting part of this enrichment was when he told us that our senses are part of physics. Another one was where he proved that everybody always has a blind spot in one part of their eyes.

--Wow, this was great! Everything Ron shows us was interesting and educational. I never knew that we all have a blind spot where our optic disk is. It was exciting to learn about the saturation of cones for different colors. Also, it was amazing to learn why we don't see rainbows in winter. Honestly, I never really thought about it until then. Mr. Schuchard taught us that our eyes are very complex and interesting mechanisms. The only improvement would be that his performance could have lasted longer. Everything he showed us was amazing and wonderful. WOW, again!

Finally, on Friday, Nov. 22, we made our annual all-day field trip to the **NUCLEAR RESEARCH REACTOR and PHYSICS DEPARTMENT** at the University of Missouri-Columbia campus.

Some student comments were:

--At the reactor, we saw the various crystals which were "altered" in the reactor. For example, the clear crystals came out with a blue tint. The reactor is used to make radioisotopes, test ancient artifacts for age, among other things. I did notice a pressure change as we walked into the reactor area. The speaker mentioned that they keep the uranium locked away because they are afraid it would be stolen.

--We saw the reactor from the top. (It was pretty. I was surprised.)

--We visited the nuclear reactor, and observed the blue glow caused by the radiation coming off of it. I got a little scared when I entered the building, because there was a contamination detector at the door. I didn't know if I would leave with extra fingers and toes, or if I would have a blue glow when I went back home. I guess I'm alright because the contamination detector didn't go off.

--I saw the lovely blue glow and an interesting board which showed mercury iodide. Those were the best parts of the reactor. The MU physics department was better. They mentioned bucky balls, lasers, diamonds, and coke cans. I most enjoyed the lady who showed us the analyzing machine which could determine what was in a substance, and a computer could create a graph of its make-up.

--I was surprised by how small it (the reactor) was and how many precautions they must make.

--We learned how the reactor produces energy from neutrons and electrons. This energy is used to date artifacts. The reactor gives information such as what the artifact is made of and the scientists could link it up with other artifacts that is made up of the same material.

--Some of the instruments used at the Research Reactor are a high resolution powder diffractometer, a reflectometer, a triple axis

spectrometer, a neutron interferometer, a single crystal diffractometer, and a small angle scattering spectrometer. In the physics department, four different people talked to us about various areas. One talked to us about light, another about being able to see individual atoms, and another about the achievements of MU physics alumni. I really enjoyed this field trip. It was a real learning experience.

--Our leader said it (the reactor) produced more power than any other university reactor in the U.S. We also talked about radio-pharmaceuticals. This was about curing bone cancer and kidney cancer.

UPCOMING

On Dec. 6, our last enrichment date before Christmas break, Frank Booth, a forensic chemist from the Kansas City Regional Crime Lab, will speak about **SCIENCE IN THE CRIME LAB**.

Friday, Jan. 3, we'll hold our annual **PANEL DISCUSSION AND REUNION** with current and former MPI students.

Our Jan. 10 speaker is Sam Gill who is an instructor at Johnson County Community College where he teaches Critical Thinking, and has written for The Skeptical Inquirer magazine. He will discuss **UNSOLVED MYSTERIES**.

Finally, on Jan. 24, UMKC Physics Professor David Wieliczka will bring back his popular talk **LASERS AND HOLOGRAMS**.

NEW (OR CHANGED) MPI ALUMNI E-MAIL ADDRESSES

[A complete list of known MPI Alumni e-mail addresses is available on request.]

**** NEW ****

(95-96) Ragan Buckley
buckley@fas.harvard.edu
HARVARD UNIV

(95-96) Julie Domsch
st073452@vax1.rockhurst.edu
ROCKHURST COLLEGE

(95-96) **Matt Sheffield**
matthewwinld@cctr.umkc.edu
UNIV. OF MO-KANSAS CITY

(95-96) **Jennifer Watts**
ST073208@vax1.rockhurst.edu
ROCKHURST COLLEGE

WE HEAR FROM PAST STUDENTS

MATT SHEFFIELD (95-96)
(Political Science Major)

E-mail received 10-9-96:

"I've been meaning to email you and thank all the faculty at MPI for the wonderful experience it was for me (one less year of math isn't a bad deal either). To those students considering dropping MPI, I highly recommend you don't. You'll be glad you attended MPI.

I also wanted to tell you my email address in case you don't have it already it's matthewwinld@cctr.umkc.edu. It might change to something more rational when I get a job as a computer assistant.

Currently, I am a political science major (subject to change) and involved with the Honors Program here at UMKC. I also have been working on my WWW site (<http://cctr.umkc.edu/user/matthewwinld>) and have big plans for it -- suggestions are welcome."

RAGAN BUCKLEY (95-96)
(Government Major)

E-mail received 10-21-96:

"Hello! Well, I've been at Harvard for about a month and a half now, and things are hectic. I'm in four classes, Chemistry, Expository Writing, Introduction to Computer Science, and The American Presidency. No math, I know, but since I'm going to major in government, I don't have to take any. I still have not mastered the skill of time management. I spend an inordinate amount of time writing email and playing with various other things on my computer, and probably not as much time on homework as I should. I guess that's no different from home, except now I have an ethernet connection instead of a modem, so it's all a lot faster.

Well, if anybody wants to email me, feel free to. I check my mail lots and I usually get back to it soon after I receive it. I don't have a lot going on, other than school at the moment, but my mom sent me the newsletter and so I thought I'd say hi to some of the people back home.

P.S. I have a web page. It's not much at the moment, but I'm going to work on it: <http://www.fas.harvard.edu/~buckley>."

JENNIFER WATTS (95-96)
(Mathematics/Pre-Medical Major)

E-mail received 11-21-96:

"School is going great. Classes are fine and of course social life is good too. I am enjoying my calculus class and I have decided to be a math major. From there I plan on either going to med school or physical therapy school. Next semester I have to take physics and you know how much I love physics!! However, with my math background they are going to let me start in calc based physics II so I got lucky since I don't have to take calc based physics I.

Well, I need to be going now - homework is calling my name!"

MPI E-MAIL ADDRESS:

rdelaware@cctr.umkc.edu

A list of known MPI Alumni e-mail addresses is available on request.

MORE 1996-97 STUDENT FIRST IMPRESSIONS

"MPI has been a good learning experience. So far it has been a lot of hard work and effort, but it is worth it. I've enjoyed all of our labs and our enrichments. I've had fun meeting the kids from the other schools, making new friends. The best thing so far is getting the experience of what college classes are like."

Jennifer Coonts
Truman High School
Independence School District

"MPI has been a positive learning experience for me. It has also proven to take plenty of dedication, time, and hard work. It took awhile to adapt to everything, but now that I have, I've been able to relax, and have fun with everything - especially the labs. The highlight of MPI is getting to know other students from different schools. Everyone works well together and the teachers are great!"

Shauna Tuiono
Ft. Osage High School
Ft. Osage School District

"My impression is simply three words: stressful, challenging, and time-consuming."

Susan Jensen
Wm. Chrisman High School
Independence School District

"There is nothing easy about MPI. You have to be here every day, study every day, and do all the suggested problems. At first I didn't think I would make it. But now that I almost have the art of studying down, I am feeling a lot better. In a lot of cases, it is almost as if the teachers expect for you to teach yourself. They teach you the concepts, but it is your job to understand and learn it. I don't love MPI, in fact, in some cases I hate it. But I am glad I can be here."

Duwan Harge
Van Horn High School
Kansas City, MO School District

"When I first came to MPI, I had no idea what to expect or what would be expected of me. All I knew was that these were college classes and would require a lot of work. Yes, the classes require a lot of work, and I must study hard. But, it is a very satisfying feeling when I turn in my homework, to know that I did my best and conquered a difficult assignment. The teachers have been very supportive of all of us. They are willing to help and answer questions. The teachers are interested in us as people and desire to see us succeed in life. Already

MPI has taught me many things about calculus, physics, myself, and what I can expect at college next year. It has been a real learning experience and I am glad that I am able to have this wonderful opportunity."

Misty Piatt
Center Place Restoration School
Independence, MO

A SOLUTION TO MATHEMATICS CHALLENGE #45

Recall the problem statement:

Let the function "f" be defined on positive integers n as:

$$f(3n) = \begin{cases} 1 & , \text{ for } n = 1 \\ n + f(3n-3), & \text{ for } n > 1 . \end{cases}$$

Find the value of f(12).

[From: Challenging Problems in Algebra, by A.S. Posamentier & C.T. Salkind, Dover Books, 1970, #10-1, p.146.]

SOLUTION:

Since $f(12) = f(3 \cdot 4)$, and by definition $f(3) = f(3 \cdot 1) = 1$, a straightforward, but unenlightening calculation gives:

$$\begin{aligned} f(12) &= 4 + f(9) \\ &= 4 + 3 + f(6) \\ &= 4 + 3 + 2 + f(3) \\ &= 4 + 3 + 2 + 1 \\ &= 10. \end{aligned}$$

However, by observing the pattern above, with a little thought we can derive a general formula for $f(3n)$ in terms of n. First, for $n > 1$, meaning $n = 2$ and above, rewrite the definition as:

$$f(3n) - f(3n-3) = n.$$

Then, as n decreases to 2, we can write the system of equations:

$$\begin{array}{rcl} f(3n) & - & f(3n-3) = n \\ f(3n-3) & - & f(3n-6) = n-1 \\ \cdot & & \cdot \\ \cdot & & \cdot \\ f(9) & - & f(6) = 3 \\ f(6) & - & f(3) = 2 \end{array}$$

Adding these, we see they telescope, leaving:

$$f(3n) - f(3) = 2 + 3 + \dots + n.$$

Since by definition, $f(3) = 1$, we thus have the general formula:

$$f(3n) = 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}.$$

So, in particular, $f(12) = 4 \cdot 5/2 = 10$, as above.

A SOLUTION TO PHYSICS CHALLENGE #36

Recall the problem statement:

There was a pile of books on a table. I cautiously pulled a book from the middle of the pile. The books on top of the book I was taking moved along with it, but the books under it stayed in place. Why?

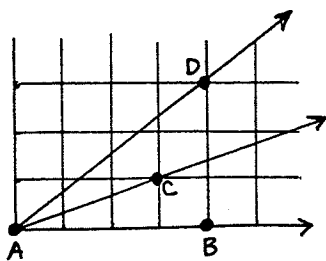
[From: Quantum Magazine, July/August 1996, Brainteaser B177, p.15]

SOLUTION:

The frictional force is proportional to the normal force. Consider the book just below the book that is pulled out. The friction between this book and the one beneath it is greater than for the one sliding along it by a value proportional to the weight of one book. This is why the book underneath stays put. The books below this one are kept in place even more firmly.

MATHEMATICS CHALLENGE #46

Three rays AB, AC, and AD are drawn from point A on graph paper as shown below.



Using the square grid, prove that the angles BAC and CAD are equal.

[From: M. Koman, Quantum/Brain teasers, March/April 1995, p. 9.]

PHYSICS CHALLENGE #37

A horse runs with a constant speed v in a circle of radius R . A person stands at a distance r from the circle's center. What is the maximum speed at which the horse approaches the person?

[From: A. Bytsko, Quantum Magazine, March/April 1995, P 136, p. 29.]

Editor/Writer: Richard Delaware

The $M\pi$ Newsletter is typed in WordPerfect 5.1 with MoreFonts and 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 (MPI), 600 W. Mechanic, Room 224, Independence, MO 64050, phone (816) 235-1272, e-mail: rdelaware@cctr.umkc.edu. Please address all correspondence concerning this newsletter to 'M π Newsletter'.