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Associate Director: Richard Delaware, Ph.D.

April 1, 2003

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Vol. 17, No. 5

Year 19 - The Last:
MPI is terminated by UMKC

UMKC has decided to terminate the MPI program as of June 30. It is a blow to all of us here, and to the 50+ students who had planned to come next year. These very words are difficult to write. We had hoped for a better result. The last two years we successfully added the school districts of North Kansas City and Hickman Mills to our original group of Fort Osage, Independence, and Kansas City Missouri, with Center, Blue Springs, and Grain Valley districts all showing strong interest. Our current faculty may be the strongest we have ever had. The MPI is still robust, both academically and financially.

Although this termination means the Director, Associate Director, and our Secretary will no longer work at the MPI, the Independence District has decided to preserve as much of the program as they can in some fashion not yet fully delineated. We hope that some remnant will remain for those 50+ students.

ODDS AND ENDS

On January 27 and 28, our two Recruitment Days, we hosted approximately 64 high school juniors and several teachers and counselors, from 6 different high schools: Center Place Restoration, Ft. Osage, Grain Valley, St. Mary's, Truman, and William Chrisman.

On January 31, the Director Elizabeth Stoddard and Associate Director Richard Delaware produced a long report on the success of the MPI and at a meeting presented it to the Superintendent of the Kansas City Missouri School District in order to discuss their continued participation in the MPI.

On February 5, Elizabeth Stoddard made a recruitment visit to Ruskin High School in the Hickman Mills district, meeting with several students excited about attending the MPI next year.

On February 26, Elizabeth Stoddard made another recruitment visit to North Kansas City High School in the North Kansas City district, again meeting with several students about attending the MPI next year.

During February 28 - March 1, Sheri Adams attended the Missouri Mathematics Leadership Conference at the Lake of the Ozarks.

On March 7, Richard Delaware spoke in the UMKC Department of Mathematics and Statistics Expository Talks Series on "Quintessence of Dust: Georg Cantor Teases Apart the Real Number Line."

On March 13, Josh Tanner (MPI 01-02) visited from Wentworth Academy. He tells us he has now been accepted and will attend the Air Force Academy next year!

On March 18, the Director and Associate Director produced another report on the success of the MPI and how it conforms to the goals of UMKC, and sent it to the Provost. We included the following quote:

"The MPI is much different than other programs for gifted students I have been involved in

MPI ALUMNI
HAVE YOU GRADUATED FROM COLLEGE?
If So
Please Consider Being An
- ENRICHMENT SPEAKER -
Contact us at (816) 235-1272
or mpi@umkc.edu
MPI Alumni who have spoken:
Doug Bullock (84-85)
Brent Harding (84-85)
Pam Deters/Stephen Koop (84-85)
Seth McMenemy (88-89)
Tony Thornton (88-89)
Mitch Dobson (89-90)
Rachel Allen (92-93)

in the past. The summer after my sophomore year I attended the Missouri Scholars Academy, or MSA. MSA is a great program but it was more about getting to spend time with other gifted students and expanding your horizons through classes about things like Philosophy and time travel. The MPI is different in that whereas MSA gave me a small taste of many different subjects, the MPI is giving me an in depth background in Calculus and Physics. MSA got me excited about learning but MPI is actually teaching me a lot. Of course, it's easier for the MPI to do this since it is a full nine months instead of just three weeks like MSA."

In March, Elizabeth Stoddard had an article accepted for publication in Physical Review Letters.

During April 8-11, Elizabeth Stoddard will attend the Urban Education Corps Conference in New Orleans, LA.

From June 2003 - June 2004, Sheri Adams will work with faculty from the Metropolitan Community Colleges and Avila College to mentor 4th grade teachers in mathematics related to an Eisenhower grant of Career Consortium Schools.

ENRICHMENTS

FOLLOW UP

On Friday, January 31, Caroline Davies, UMKC Geosciences, spoke on "USING LACUSTRINE SEDIMENTS TO RECONSTRUCT PALEOENVIRONMENTS OF THE MIDDLE EAST."

Students responded:

■ Molly Davies works for the Department of Geosciences at UMKC and has recently spent much time studying in the Middle East. Molly studies environment and climate changes over time. She is able to do this by using climate proxies, which are things from the past that can reconstruct climates. Climate proxies include pollen, microfossils, soil chemistry, and atmospheric isotopes. Molly notes that other civilizations have altered environments and climates through deforestation, since wood was needed in the process of making plaster, copper, and other materials. Molly believes that climate changes happening today may be because of both human and natural causes.

■ It was an interesting presentation, especially for a geochem freak...like me.

■ Dr. Davies talked about her exploration of the Middle East. Her fantastic photos accompanied her knowledge. She had a highly interesting topic.

■ The speaker was great and very knowledgeable.

■ Molly did an excellent job of presenting information about Lake Sediments in the Middle East.

On Friday, February 28, we made a two-part **FIELD TRIP**:

In one part of the trip, we toured **UMKC PHYSICS DEPARTMENT LABS** and heard about some of the ongoing research there:

- Professor Jerzy Wrobel's study of semiconductor properties with Photo-Luminescence.
- Professor Fred Leibsle's study of Metallic and Magnetic films with Scanning Electron Microscopy.
- Professor David Wieliczka showed the undergraduate optics laboratory with some experiments performed by UMKC undergraduates set up.

In the other part, we visited the Rare Book Room of the world-class **LINDA HALL LIBRARY OF SCIENCE** (surrounded by the UMKC campus, though independent of it), and examined original editions of historically significant books on mathematics and physics such as:

- Works by Newton (1736 edition) and Leibniz (1684), co-inventors of Calculus
- The first Calculus textbook, written by L'Hospital (1696), and the second by Maria Agnesi (1801 edition)
- Three versions of Euclid's Elements, including the earliest printed version (1482), and first English edition (1570)
- Works by Archimedes, Barrow (Newton's teacher), Boole, Boyle, Descartes, Euler, Galileo, Maclaurin, Simpson, and Wallis, among others

Students responded:

■ This was a fascinating journey through UMKC as we got to go and see the research that is taking place in the Physics Department. We got to meet many of the professors of the Physics Department during our tour. We heard talks about lasers, objects under high pressure, and many other extraordinary and interesting things. We also visited the Linda Hall Library, where I was blown away by just being in the presence of books that are hundreds of years old. We got to look through many of these ancient books. I was quite fascinated.

■ We went to the campus and toured both the physics department and the Linda Hall Library Rare Book Room. In the physics department we saw various labs and talked to 5 different professors. I

definitely learned that there is a lot more to physics than I had thought; it covers a wide variety of fields. I really enjoyed the Rare Book Room. I think it's cool that all those old, important books are so close at hand to regular people. Also, we ate lunch there and saw a pretty cool projector.

■ I LOVED this field trip. The physics section gave me a whole new look on what professors of science do. Also, the books were so neat to read. It was cool handling works also handled by Newton. In addition, the field trip gave us time to get to know other students in other sections.

■ I really enjoyed seeing the different experiments. Seeing what scientists really do was interesting.

Writing Assignment:

After the field trip, students were required to type a response for Calculus credit about the books they personally examined. Here are some excerpts:

"I wandered around for a bit before I found the one book I already knew I wanted to look at. Analytical Institutions by Maria Gaetana Agnesi was the only book we had the option of looking at written by a woman. I'd already read the biography provided in our assignment packet and was very much in awe of her obvious brilliance.

It began with a dedication to Maria Teresa of Austria. This was something Mr. Delaware had told us might be at the beginning of many of the books. He had also warned us that many of the s's may look like f's, as they did in this book. Still, I had to laugh when I had trouble deciphering the words because I couldn't figure out which letter it was supposed to be.

Finally I came to a section that was actually useful. The translator was discussing why he had decided to translate the book, and what the book contained. He said he wished to translate it from Italian to English in hopes that it might 'excite the curiosity of some of our English Ladies'. Again, I laughed."

Rachel Van Tuyl
Fort Osage High School

"I then perused *Mathematicall magick, Or, The Wonders that may be performed by mechanicall geometry* by John Wilkins. This was probably my favorite of the books. Some of the subjects discussed are perpetual motion, the viability of a submarine, and the possibility of flight. Wilkins writes of the problems of making a submarine, such as how the oars would be placed on it and how one could row underwater. He seemed to claim that many of the problems could be solved by leather sacks, but I am not sure how. Wilkins also writes about the three

possibilities for flight: 1) the use of some apparatus that one rides on, 2) the attachment of wings to the person, and my personal favorite, 3) the use of fowl, in which one ties oneself to birds and somehow steers them using an elaborate set of reins. Finally, Wilkins writes of perpetual motion and the various ways people have attempted to create it, such as with magnets, chemistry, and gravity. Wilkins does not call perpetual motion impossible, but he doubts that it is possible. He calls perpetual motion a 'chaste whore, because it allures many and admits none'"

Matt Orlovick
William Chrisman High School

"It was really fascinating to see how some of the basic ideas of calculus today developed in this book. Since this book was easy to understand, I could see very clearly a rough outline of the definitions and ideas that are in *my* calculus book. For instance, take this paragraph out of Agnesi's textbook:

'Any infinitely little portion of a variable quantity is called its Difference or Fluxion; when it is so small, as that it has to the variable itself a less proportion than any that can be assigned; and by which the same variable being either increased or diminished, it may still be conceived the same as at first.'

Wow! This passage is an early definition of derivative. Throughout the whole book there are neat proofs, pictures, examples, and definitions like this one. I also found a theorem having to do with area under the curve using rectangles, rules on how to find derivatives for fractions and square roots, and many example problems that I could work through.

I really enjoyed reading through *Analytical Institutions*. Of all the books I looked at in the Rare Book Room, I found this one to be the easiest to read and apprehend. Even the *pages* were soft and easy to turn. I would recommend others to go to the Linda Hall Library just to read this book."

Jason Hamilton
Center Place Restoration School

"The visit has spurred me to visit the Rare Book Room on my own to read even more. These books have really caught my attention."

Joey Hare
St. Mary's High School

"I cannot believe I was reading original books written and used by some of our mathematical 'founding fathers.'"

Matt Perry
Truman High School

"This week's enrichment was very cool. I especially liked looking at the old books. When I first heard about the trip and what we would be doing, it did not really interest me. In fact, I thought it was going to be rather dull. However, when I actually walked into the room, sat down, and flipped through the pages, they were fascinating. In most of the books, the pages were worn and brittle, and the margins were filled with notes people had jotted down. It was very intriguing. It felt almost like stepping back into time."

Cathy Martens
Center Place Restoration School

"Although it was pretty cool that I got to touch a book from the 1400's, the main lesson that I learned is that if the right person sat down and read a book in math in a totally different language that he or she would be able to understand most of what the book is talking about. Confirming the saying that I have heard numerous times throughout my life, math is the universal language. I appreciate the fact that I was able to witness this first hand."

Ryan Larson
William Chrisman High School

"I got to read first-hand one of Berkeley's most famous passages:

It must, indeed, be acknowledged, that he used Fluxions, like the scaffold of a building, as things to be laid aside or got ride of as soon as finite lines were found proportional to them. But then these finite Exponents are found by the help of Fluxions. Whatever therefore is got by such Exponents and Proportions is to be ascribed to Fluxions: which must therefore be previously understood. And what are these Fluxions? The Velocities of evanescent Increments? They are neither finite Quantities, nor Quantities infinitely small, nor yet nothing. May we not call them the Ghosts of departed Quantities?"

Kris Vaught
Fort Osage High School

On Friday **March 14**, William Morgan, UMKC School of Biological Sciences, spoke on "PROTEOMICS".

Students responded:

■ Dr. Morgan gave a presentation on Proteomics, which is the comparison of proteomes under various conditions. A proteome is a protein complement to a genome. According to Russell Doolittle, "DNA makes RNA, RNA makes proteins, and proteins do everything else." Proteomics is done through DNA cloning and sequencing, x-ray crystallography and NMR spectroscopy, DNA and

Protein arrays, mass spectroscopy, and computer analysis.

■ He talked about Proteomics, which is the study of proteins. He wants to know the whole life span of a protein.

■ Dr. Morgan's presentation on the exciting world of Proteomics was very fascinating. I found it to be very interesting and I enjoyed listening to him.

■ I would like to hear more about how Proteomics relates to Physics.

■ I'm glad I took AP Biology, so I knew what he was talking about.

On Friday, **March 28**, Mitchell Dobson (MPI 89-90), spoke on "PRINCIPLES AND ADVANCEMENTS IN PROSTHETICS."

Students responded:

■ The new "C-Leg" is a new advanced knee/shin prosthetic limb that is computer generated. It is the closest thing to real limbs so far, allowing the patients to walk and run with ease and go down stairs or slopes. With new materials being tested, Prosthetic limbs are continually becoming lighter and stronger (Titanium rather than steel). One of the big improvements in the fields is the use of a CAD program to measure and modify prosthetic limbs in order to produce correct limbs quicker and easier. Stance Control Knee Braces (allows paraplegics to stand) and new prosthetic hands (allows proportionate grip/control) are more of the newest advancements in the field.

■ He discussed many of the areas that came into play when creating prosthetics, such as Material Science, Product Engineering, Computer-Aided Design, Computer-Aided Manufacturing, and Electronics Development. Some of the products his company makes are the C-leg, Stance Control Knee Brace, MYO Electric hand, and the Flex Foot. He also discussed Prosthetics as a career.

■ Mr. Dobson's presentation was very cool. He showed us a video about some of the new advancements that they have had in prosthetics. He also showed us some of the new materials they use to make the prosthetics and how these have really improved people's lives. I also thought that their use of computers is very cool.

■ Mr. Dobson's presentation was awesome. I really enjoyed it. I think it is very cool how he is helping many people.

■ I'm sorry to admit that prosthetics have always kind of creeped me out. I think because they bring up the thought of losing one's own limbs. For this reason, I'm glad I got to see a presentation on prosthetics and the good they do for people.

■ Very interesting. The careers in prosthetics seem challenging and rewarding to people in many fields and not necessarily just scientific ones.

UPCOMING

On Friday, April 11, Tina Niemi, UMKC Geosciences, will speak on "EARTHQUAKES IN MISSOURI."

On Friday, April 25, Brent Harding (MPI 1984-85), Engineer Specialist, will speak on, "APPLICATIONS OF SATELLITE TECHNOLOGY."

Saturday, April 26, and Sunday, April 27, will be our annual WORLDS OF FUN PHYSICS DAYS.

Finally, we'll hold our annual BREAKFAST on Wednesday, May 7, and our AWARDS PRESENTATION on Thursday, May 8, the last day of MPI classes this year.

WE HEAR FROM PAST STUDENTS

Angelina Walls (98-99)
Applied Communication Studies/Theology Major
Creighton University

"MPI really taught me how to study. That is so critical when going to college. You need to know how long it will take you to do an assignment. You need to be able to find a study plan or style that works best for you. And most of all, you cannot be afraid to work hard. This is where you will see a lot of the effect MPI will have on future education.

Don't be intimidated. You can do it! It seems difficult but it will prepare you far greater than you realize."

Cris Dykeman (95-96)
BA Psychology
Graceland University
MA Psychology Student
Georgia School of Professional Psychology

"Although I did not continue to (intensely) study math or physics, what I learned at MPI laid a wonderful foundation and has helped immensely in other areas such as preparing me for college studies

and helping to increase my knowledge while conducting (Psychology) research."

FINAL 2002-2003 STUDENT IMPRESSIONS

"The MPI is a great program. It aptly prepared me to the reality of what I can expect from a college course. Unlike a high school course, you MUST study and do homework. However, the professors here are not going to hold your hand and walk you through it. They are more than willing to help you, although they will be severely agitated if you ask for help after sleeping through a lecture. Best advice? Take notes. Study. Show up. Result? You pass."

Kris Vaught
Fort Osage High School
Fort Osage School District

"Now that the 'MPI Experience' is almost over, I have become giddy with excitement. The realization has hit me that there are less than two months of classes left. Only two more months of cramming for tests, pretending to be on the same page as my instructors, having a lost and confused look on my face during computer labs, worrying about getting up in the morning, contemplating how to turn my half-page writing assignment into a three page writing assignment, and not feeling bad about failing a test because everyone else failed it too.

I am happy mainly because summer is fast approaching; but I am also thrilled to be close to surviving the most challenging classes I have ever taken. I now know what studying is all about, and I have learned that when you put forth effort, you get much in return, but if you do not put forth effort, you get little in return. I am sure these tidbits of knowledge will help me get through college down the road.

Thanks MPI teachers for your willingness to pound information into my brain. This whole year could have been a total loss if it weren't for all of you."

Jason Hamilton
Center Place Restoration School

"Going into MPI, I was scared to death. The thought of it made me sick. As the year has gone on, I have become accustomed to it, and it is actually kind of fun. I'm glad I decided to be in this program since it has given me a preparation for college."

Roberta McKinney
Truman High School
Independence School District

"Your experience at MPI will be very beneficial to your education and college preparation, but you must put out an effort stronger than anything required in high school. If you are willing to work hard, then it's worth it."

Bradley Taylor
St. Mary's High School

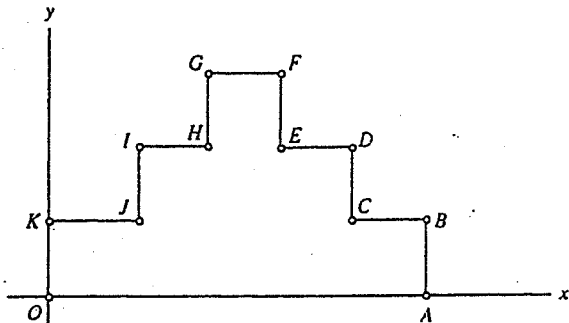
"The experience at MPI this year has been great. The MPI has taught me many skills that I believe will better prepare me for college than any normal high school class could. The instructors at the MPI are always willing to help which creates a good learning atmosphere. To any incoming students, I won't lie and tell you things are easy at the MPI. It requires dedication and hard work to do well, but in the end, it is well worth it. Also, a tip to incoming students: Do not blow off the first exam thinking it will be your average high school test. Prepare well and blow your instructors away. VIVA LA SECTION C!"

Adam Nichols
Truman High School
Independence School District

A SOLUTION TO MATHEMATICS CHALLENGE #77

Recall the problem statement:

In the polygon shown below, side OA has length 5, while all the other sides of the polygon have length 1.



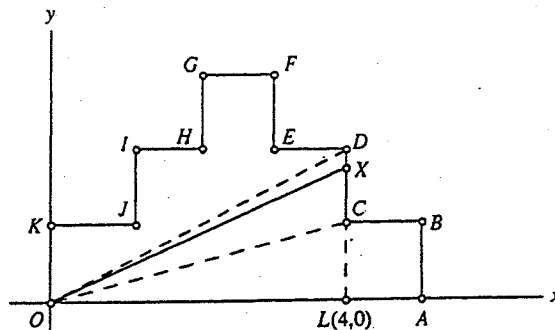
Find the (x,y)-coordinates of the point X on the boundary of the polygon so that the line segment OX bisects the area of the polygon.

[From: Mathematical Chestnuts From Around the World, by Ross Honsberger, MAA, 2001, problem #3(ii)(a), p. 126, from Bulgaria.]

SOLUTION:

The area of the polygon above is 9 square units. So, the bisecting segment OX must have 4.5 square units

on either side of it. Extend the line segment DC downward to meet OA at a point L with coordinates (4,0), as in the sketch below.



Observe that triangle OCL together with the unit square LCBA has combined area $(1/2)(4)(1) + 1 = 3 < 4.5$. Similarly, triangle ODL together with the same unit square has combined area $(1/2)(4)(2) + 1 = 5 > 4.5$. So, X must lie on the line segment DC. In fact the area of triangle OXC must satisfy

$$\begin{aligned} (1/2)(XC)(4) &= 3/2 \\ XC &= 3/4 \end{aligned}$$

in order that the area of the polygon below OX be 4.5 units. Therefore the (x,y)-coordinates of the point X are (4, 7/4).

A SOLUTION TO PHYSICS CHALLENGE #68

Recall the problem statement:

Here's a relativity question known as the "Twin Paradox":

Let's say you have a twin who decides to become an astronaut and go on a high-speed trip through space. When your twin takes off, you think, "I am at rest and you are very quickly moving away from me. Your clock is running too slow, and you are aging more slowly than I am!" But, your twin looks out the window, and thinks, "No, it is you who are very quickly moving away from me! It is your clock that is going too slow and you who are aging more slowly."

Since each frame of reference is a valid "rest" frame, both of you should be correct. However, when your twin returns to earth, which twin has aged more?

SOLUTION:

In the end, both twins will agree, after checking their watches, that the twin who went on the trip is younger. The reason for this is that the traveling twin underwent acceleration; so only the twin who stayed home remained in a valid "rest" frame. During acceleration and deceleration of the

rocket ship, time goes more slowly for the traveling twin, on which both twins agree.

So, the Twin Paradox is only a paradox while the twins are traveling at constant speed with respect to each other, and when the traveling twin decelerates to join his brother, the paradox is resolved.

MATHEMATICS CHALLENGE #78

Three stationary sentries are guarding an important public square, which is, in fact, a square, with each side measuring 8 units. If any of the sentries see trouble brewing at any location on the square, the sentry closest to the trouble spot will immediately cease to be stationary and dispatch to that location. These three sentries are continually looking in all directions for trouble to occur. Regardless of the positions of the sentries on the border of or within the square, will there always be a potential trouble spot that is more than 4 units from any sentry?

From: The Inquisitive Problem Solver, by Paul Vaderlind, Richard Guy, and Loren Larson, MAA, 2002, p.55, P236. [Adapted from a problem composed by David Savitt and Russell Mann for the 9th annual Konhauser Contest held at Carleton College in March 2001.]

PHYSICS CHALLENGE #69

Let's now turn our attention from relativity to rotational motion. Piloting a single-propeller airplane can be quite tricky especially in take-off and landing since the motion of the propeller makes the whole airplane behave like a large gyroscope. For example, let's say that the angular momentum of the propeller at the front of a small airplane points forward, meaning the propeller moves counter-clockwise as viewed from the front. As the plane prepares to land and the nose is directed more downward, the airplane tends to veer to one side. To which side does it veer?

(Obviously, it is important to foresee this tendency as a pilot, so you can correct for it by steering in the opposite direction in order to continue straightforward to the landing strip.)

Answer: To the left.

Editor/Writer:

Richard Delaware

This $M\pi$ Newsletter is typed in Microsoft Word 2000 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: mpi@umkc.edu. Please address all correspondence concerning this newsletter to 'M π Newsletter'.
