Mπ The Mathematics and Physics Institute NEWSLETTER

Director: Jennifer Snyder
Associate Director: Richard Delaware

February 1, 2000 **Vol. 14, No. 4**

FIRST SEMESTER – TOP TEN

By taking the mean of their college calculus and physics grades for the first semester, we have determined our current Top Ten MPI students. We congratulate them all. Listed alphabetically by schools, they are:

Brad Carrow	Fort Osage
John Hershberger	Fort Osage
Sarah Smith	Paseo Academy
Amanda Thatch	Paseo Academy
Matt Lane	Truman
Megan MacDonald	Truman
Cassy Pallo	Truman
Sam Slee	Truman
Ryan Williams	Truman
Lyndsey Main	Wm. Chrisman

RECRUITMENT DAY – FEBRUARY 8TH

On **Tuesday, February 8th**, we are inviting for a visit all interested juniors and their teachers from the high schools involved in the MPI program. (Last year we hosted about 153 students.) They will arrive between 8:00 and 8:10am and, with MPI student tour guides, take a short tour of the MPI classrooms. There will be MPI students at work on Calculus, a Physics lab set-up for viewing, and problem-solving sessions in action. Following the tour, everyone will be led to Rm. 207, to receive an MPI brochure, this issue of the Newsletter, a sheet containing information about the Calculus Readiness Test and MPI Mathematics Technology, donuts, and at 8:30am, be seated for our slide show which includes computer, calculator, and physics demonstrations. Afterward, we'll all take questions from the audience, finishing up at about 9:30am.

TO ALL MPI ALUMNI:

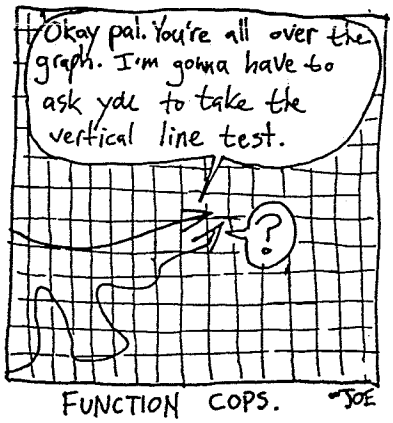
HAVE YOU GRADUATED FROM COLLEGE?

IF SO:
PLEASE CONSIDER BEING AN
- ENRICHMENT SPEAKER -
CALL (816) 235-1272
or contact us at our **NEW E-MAIL:**
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)

A CARTOON BY JOE MOCCIA, PASEO ACADEMY



ODDS AND ENDS

On **December 7**, our MPI calculus instructor from Wm. Chrisman High School, Libbi Sparks, gave birth at 1:20pm to her second son, Nathan Glen. After a much needed rest, she's back with us now. Welcome back, Libbi!

The latest MPI T-shirts and sweatshirts arrived on December 8, in blue and gray, we distributed them to students.

ENRICHMENTS

FOLLOW UP

On Friday, **December 10,** Frank Booth, a forensic chemist from the Kansas City Regional Crime Laboratories spoke on **SCIENCE IN THE CRIME LAB.**

Students responded:

- Frank works in a crime lab for the Kansas City Police Dept. He uses chemistry to determine things about the crimes including; time of death, color of hair of suspect, blood trails, and footprints. He showed us some pretty neat slides of blood and dead people. I enjoyed the part about the bullets and powder burns. He can determine the gun that a particular bullet was fired from by looking at the rifling on the jacket. He also uses chemistry to bring up the I.D. numbers that have been filed out. Very good speaker! The ballistics and chemistry is very interesting to me.

- I thought it was a very good enrichment. He did a good job of speaking and I think this is one of the first enrichments I have been interested in. Not at all to say that the other speakers weren't good, but Booth had a more enjoyable subject matter, because you know everyone loves dead people...

- I watched on T.V., on movies, about crime investigation. Everything always made me wonder, "How did they know who did the crime?" But today, this question was answered.

- I thought this was the best enrichment we have had all year.

- I enjoyed this a lot because I am interested in pursuing a career in forensics.

Our 15th annual **PANEL DISCUSSION AND REUNION** was held on **January 4th** in Room 207, and moderated by Richard Delaware. As usual, each of the panelists discussed their college experience, their major, and/or work experience.

The alumni panelists this year were:

Jennifer Woolsey **(94-95)**
BS Accounting, Rockhurst University

Jenny Coonts **(96-97)**
Central Missouri State University

Jose' Alcocer **(97-98)**
Rensselaer Polytech.

Jenny Green **(97-98)**
Texas Lutheran University

Alicia Siy **(97-98)**
University of Missouri-Columbia

Katie Allen **(98-99)**
University of Kansas

Suzanne Leslie **(98-99)**
Truman State University

Brad Martin **(98-99)**
University of Missouri –Rolla

Josh Titus **(98-99)**
University of Missouri-Kansas City

Angelina Walls **(98-99)**
Creighton University

Their presentations were clear and perceptive.

The following is a list of the other alumni that visited. In all, fourteen former MPI students attended.

Jay Farrington (96-97)
Truman State University

Jigna Patel (96-97)
Rockhurst University

Daphne King (97-98)
University of Missouri –Kansas City

Anthony Brown (98-99)
University of Missouri – Rolla

Some specific current MPI student comments were:

- Former MPI students came to tell us about their college experiences. They say it is good to live on campus and sometimes you have to work on campus too. Some classes do not require attendance, but everyone agreed that it is a good idea to go to class. Some teachers give extra credit for attendance. Other points included staying in close contact with teachers and keeping up with homework. Cramming is bad, apparently.

- They were much better than the other speakers that discussed college. They gave us what it's like, not what to do.

- It's much more fun to have these people here. They were a lot of help to me.

- They helped me think twice about studying!

- I liked hearing firsthand college stories, especially those about classes and living situations.

- I really liked the way this enrichment was set up. There was more than one opinion on some of the subject matters. Plus, these people are very close to our age and they understand better.

On Friday, **January 14,** Steve Snyder, Director of Attractions Development at Science City, spoke on **THE PHYSICS OF TOYS.**

Students responded:

- I think that he did well in explaining how each toy related to physics and calculus.

- I liked the enrichment because I learned that just one toy can have that much physics behind it.

- He was a lot of fun and gave an excellent performance/lecture.

- This guy makes and plays with science toys. He rules! Toys are fun and neat but toys can serve as models for larger applications because physics' rules always apply.

- He was excellent. The most interesting speaker we've had.

On Friday, **January 28**, George Gale, Philosphy Professor, UMKC, spoke on **HOW MANY UNIVERSES ARE THERE ANYWAY? AND WHO CARES?**

Students responded:

- George talked about what universes are; how many there are; and where they could be. Universes are systems cut off from the outside. There's no way to send signals from one to the next. At least none that we know of yet. There are probably lots of universes, but exactly how many isn't known for sure. Universes can possibly be in three different places. In other words, there are three theories as to where they exist. First, in space where they could be infinitely extensible or infinitely divisible. Second, in another time, or thirdly, in another dimenstion.

- A very interesting and thought-stimulating topic.

- Three words: Oh my God! He was excellent and the actual subject was so amazing.

- Mr. Gale is the best speaker I've heard all year! I really enjoyed the theories dealing with religion – it's nice to hear information about these subjects without the fear of church versus state.

UPCOMING:

On **February 11,** Kathleen Kilway, a UMKC Organic and Organometallic Chemist will return to Discuss: **FROM MOLECULES TO NANOMATERIALS: THEORY AND EXPERIMENT.**

We have not yet scheduled speakers for **February 25 or March 10**.

On **March 24,** we'll take a two-part field trip to UMKC, separated by lunch, to visit both the **Physics Dept. laboratories** in the new Flarsheim building, and the **Rare Book Room of Linda Hall Library of Science, Engineering & Technology**. In Physics, last year we toured labs in Atomic Force Microscopy, Scanning-Tunneling Microscopy, High Pressure Physics, Chaos/NonLinear Dynamics, Photoelectron Spectroscopy, and Photo-Luminescence. At Linda Hall Library, we viewed rare and historically significant mathematics books including the first calculus textbook (1696), books by Newton and Leibniz, co-inventors of the calculus, several versions of Euclid's Elements, and about 20 more books. MPI students will also be required to write a short response paper for calculus class.

WE HEAR FROM PAST STUDENTS

Sheri Harrison (90-91)

E-mail received 12/12/99:

"Hello there! I haven't written in a while, so I thought I would just drop a line to let you all know what has been going on. Things have been just wonderful this past year for me. I got engaged Valentine's Day, bought a house in April, and had a beautiful baby boy on September 2nd. My life couldn't be more perfect. I still work in mortgage banking and am still trying to finish my degree. It would be a lot easier if I could figure out what exactly I want to do with my life. My e-mail address, for anyone who wants it, is jstal@planetkc.com, drop me a line! Take care EVERYONE, and I look forward to hearing from you in the future."

Andrea Slusser (92-93)
(Architectural Engineering Major)

"I am getting closer to graduating – May 2001, in Architectural Engineering. I have applied to the Navy Corps of Engineers (Civil) as an officer. I am awaiting the Officer Candidate Selection decision. If accepted, I will go to OCS in Pensacola, Florida, in the summer of 2001, and have requested overseas stationing. At this time in my life, I am not interested in starting a family. My primary concern is graduating from college. As far MPI; it was a wonderful experience, however for students who go on to attend large universities it will be a shock to walk into a calculus lecture with 1,000+ students in the lecture hall. I definitely recommend MPI to students seeking to go into engineering, math, science or the medical field. They will gain valuable experience and confidence essential to successful completion of the rest of the calculus series and their degree."

P. Huu Dang (94-95)
(B.S. Accounting)

"The best thing MPI did for me was to expose me to real college classes and help me prepare."

Aimee Newell (94-95)
(BioMedical Engineering)

"Very good transition from high school to college. I think I learned the information more in depth at MPI than I did in college. At some points, MPI gave me a good foundation to start the rest of my college career."

Tamara Calvert (96-97)
(Nursing Major)

"Well MPI taught at a much slower rates so, of course, it was easier. Most importantly, though, at MPI we got a lot of personal attention and more explanations that provided an in depth understanding that I never received in my Calc II class at CMSU. It taught me self-discipline and how to take on a challenge and believe me those are two very important qualities for a nursing student to succeed. Anatomy and physiology courses are not the easiest classes in the world!!! I did want to say I love MPI and thank you for a great experience!"

Crystal Gearke (96-97)
(Pharmacy Major)

"MPI had much better instructors who really cared for their students. Much more difficult, also. Remember I am a pharmacy student and don't need a lot of math or physics. I am only in my third year and have enough to be considered a senior level, not junior level. In Pharmacy School, 2 prerequisites are physics and calculus, so during Pre-pharmacy I was taking Pharmacy School classes. Being ahead makes pharmacy school much easier. If you can make it through MPI as a high school student, you can make it through whatever you want to in college."

Rebecca Herling (96-97)
(Business Administration)

"MPI courses were less of a "weed-out" class than Calc II was at Mizzou. So I think the level of instruction and explanations were better at MPI."

Brian Johnson (96-97)
(Computer Science)

"The MPI gave me realistic insight into a college lecture experience."

Jessica Ostrom (96-97)
(Secondary Math Education Major)

"The quality of the courses I took at MPI was comparable to or better than most of the math and physics courses I have taken since. It gave me a nice head start on my math and physics courses in college and introduced me to the level of work required in a college course."

Jigna Patel (96-97)
(Biology)

"The calculus class and physics class that I took at MPI are very competitive compared to the ones here. I haven't gone further in math than Calc I, but I heard Calc I is hard here. As far as physics, I took it over the summer and that was a cinch. MPI physics was harder. MPI helps with what to expect in college. I still follow the group studying method."

Teresa Schlueter (96-97)
(Cellular/Molecular Biology Major)

"MPI classes are of a very high quality. The rigorous schedule of MPI kept me on my toes and prepared me for the time management needed in my current college courses. Although I have it slightly easier because classes begin at 8:00am and not 7:00am! MPI encouraged me to pursue higher education to the fullest. I received constant encouragement to do my best and try to overcome any challenge. Even today, I still refer to MPI as a valuable eye opener for college and finals. Keep up the good work!"

Samantha Webb (96-97)
(Biology Major)

"Instruction at MPI was a much higher quality education. I haven't had the small classroom setting and more individual attention since MPI. I am still learning the same amount, but now I do a lot more individual learning. Bottomline, MPI taught me how to study. I have the sills that gets me through day-to-day life in college. Keep doing what you're doing!"

Daphne King (97-98)
(Civil Engineering)

"I felt that the Calculus was much harder at MPI, thus providing more thought than my math courses at UMKC. I brushed up on College Algebra and Calc I, now Calc II is almost as difficult as MPI, but the quality is comparable. Make sure MPI recruiters are visiting/soliciting students from all inner-city schools. They need college prep courses."

Jason Kleyh (97-98)
(Vocal Music Major)

"MPI helped me learn how to study and use time more efficiently. MPI was very challenging but rewarding. In taking it, I do not have to take any more math classes."

Courtney Jones (97-98)
(Elementary Education Major)

"I've only had one other math course, and it was a very simple course for Elementary Ed. majors. Even though it was simple material, my teacher made lots of mistakes. The quality of instruction is definitely higher at MPI."

Michelle Bailey (98-99)
(Pre-Law Major)

"The MPI prepared me for what to expect in college and how to deal with different problems. Keep up the good work. I see so many people having trouble understanding things and they don't do anything but complain about it. I just study more and do some extra exercises and ask the professors for help if I'm still stuck."

Suzanne Leslie (98-99)
(Physics/Spanish Major)

"I really think that the Calc II class at MPI did a lot for me. It forced me into a regime of study that is still in progress. Prior to MPI, my study skills were nonexistent. Through MPI I began re-evaluating studying for tests and on a more regular basis. I really enjoyed the enrichment speakers. Through their exposure I felt we were able to see where many of these skills could take us and what careers are available. MPI really made me decide how seriously I was going to take academics in general and calculus in particular. I loved the challenge and think that the program is great. Being removed from high school really helped solidify a more "college-type" atmosphere for the classes. The teachers were also great and very interested both in the students and enthusiastic about the subject matter."

Angelina Walls (98-99)
(Undecided Major)

"Because of MPI, when I have a lot of work to do, I'm not afraid to dive in. I have learned to keep thinking and trying until I figure out the answer. MPI made me a harder worker. MPI not only prepares you for college, it's fun too!"

NEW MPI E-MAIL ADDRESS:

mpi@umkc.edu

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

MORE 1999-2000 STUDENT IMPRESSIONS

"Even though MPI is stressful, as many students may describe it, it is beneficial for our future in college. Furthermore, I appreciate being in MPI because my study habits have flourished as well as my grades. More importantly, however, I appreciate the efforts by the teachers in helping us succeed."

Herber Hernandez
Northeast High School
Kansas City, Missouri School District

"Is MPI fun? If you like stress, over-working and lack of sleep, then this is your lucky day. What I've learned from MPI is you have to make it fun for yourself. If you don't have fun, you'll dread coming here so early. If you're having a bad day, I recommend the following to cheer you up:

1. Buy a diet coke from downstairs.
2. Sit on a nice wooden chair.
3. Hum a happy song (I use either the tractor song or any Britney Spears compilation.)
4. Race back to your high school as fast as you can."

Melinda Hacker
Truman High School
Independence School District

"It seems like, after awhile, you get into a rhythm for MPI. It's all about finding how little sleep and/or studying you can get away with. You also have to find a medium ground between knowing that you're a geek when you see two cars make right turns and are reminded of the graph of $y=1/x$, and not becoming a complete MPI drone by turning down every invitation to go out because you really want to get as close a score as possible to Sam on the next test. It's a balancing act, and it's been interesting to see how everyone here has handled it so far."

Amanda Thatch
Paseo Academy
Kansas City, Missouri School District

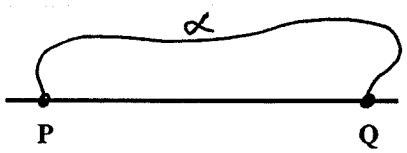
"MPI has been really great. The teachers have all been very helpful. They always have time for more questions, even if it is 10:00pm the night before a test (especially then!). If you do the homework and all the suggested problems, it's not that bad."

Sarah Piatt
Center Place Restoration School
Independence School District

A SOLUTION TO MATHEMATICS CHALLENGE #61

Recall the problem statement:

Suppose a plane arc α has length 1, and lies entirely on one side of the line through its endpoints P and Q, as shown:

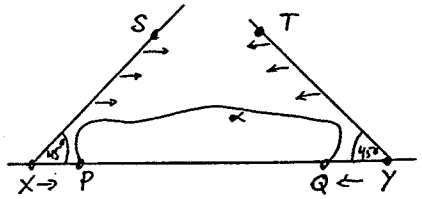


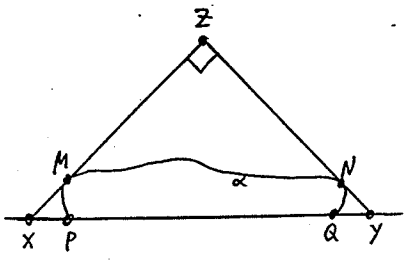
Prove that <u>every</u> such arc can be covered by an isosceles right triangle whose hypotenuse has length 1.
[Recall that such a triangle has 45, 45, and 90 degree angles.]

[From: In Polya's Footsteps, by Ross Honsberger, 1997, Problem #2, p. 157; Due to John Wetzel, Univ. of Illinois, Urbana, as Problem #759 in the Fall 1992 Pi Mu Epsilon Journal].

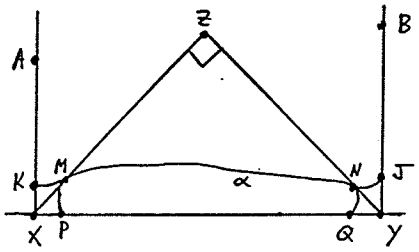
SOLUTION:

As shown below, imagine first that a line XS, at a 45 degree angle to the line PQ, slides along PQ until it just touches the arc α at a point M. Likewise, slide YT, also at a 45 degree angle to PQ, until it touches the arc α at N. Then, extend the lines XS and YT until they meet at a point Z. The triangle XYZ so formed is thus an isosceles right triangle (with right angle at Z) covering the arc α. [Note that it could happen that in fact X = P and/or Y = Q.]





We now show this triangle has hypotenuse XY of length ≤ 1. Toward this end, reflect the hypotenuse XY in the line XZ (as a mirror), to get XA. Since the two angles at X are both 45 degrees, adding to 90 degrees, this means XA is perpendicular to XY. Also reflect the arc MP in XY to get arc MK. Similarly, reflect both segment XY and arc NQ in the line YZ to get YB perpendicular to XY, and arc NJ, as shown below.

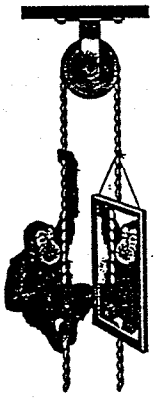


Now, of course, length(MK) = length(MP) and length(NJ) = length(NQ), so that the length of the new curve KMNJ is the same as the length of arc α, namely, 1. But KMNJ is a path from XA to YB and must therefore be in length greater than or equal to the perpendicular (and shortest) such path XY, the hypotenuse of our triangle. Hence:

length(XY) ≤ length (KMNJ)
= length (arc α)
= 1, as desired.

A SOLUTION TO PHYSICS CHALLENGE #52

Recall the problem statement:



In the figure, a massless rope is strung over a frictionless pulley. A monkey holds onto the rope, and a mirror, having the same weight as the monkey, is attached to the other side of the rope at the monkey's level. Can the monkey get away from the image that it sees in the mirror by a) climbing up the rope, b) climbing down the rope, or c) releasing the rope? Explain.

SOLUTION:

There is no way for the monkey to escape the mirror unless he waits until he falls to the ground and then runs away from it! In the situation shown, the monkey and mirror are in equilibrium. Since this is a

massless rope and a frictionless pulley, the weight of the monkey and mirror must be equal. If one were heavier, then it would hang below the other. If the monkey tries to climb up the rope, the mirror will come up with him in order to stay in equilibrium. The same is true if he tries to climb down. If he lets go of the rope, then both he and the mirror go into freefall (of course, assuming that there is no air resistance!). Since all things fall at the same rate and both monkey and mirror start out at the same height, the monkey will get to watch himself as he falls with the mirror to the ground!

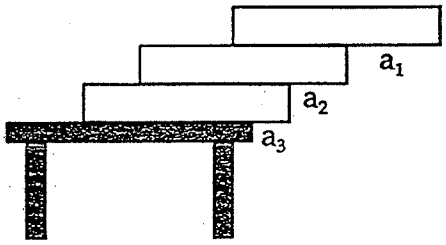
MATHEMATICS CHALLENGE #62

Suppose each point of the 2D plane is colored red or blue. Prove that some rectangle has its four vertices all the same color.

[From: Mathematical Morsels, by Ross Honsberger, 1978, Problem #8, p.15; Due to David Silverman, as Problem #138 in Vol. 3, 1959-64, p. 474, Pi Mu Epsilon Journal.]

PHYSICS CHALLENGE #53

Four identical uniform bricks, each of length L, are put on top of one another as in the figure in such a way that part of each extends beyond the one beneath. Find, in terms of L, the maximum values of a_1, a_2, a_3 such that the stack is in equilibrium.



Do you have a physics problem that you'd like to challenge the MPI students and alumni with? Send your question (with solution!) to the MPI address or e-mail to: jdiscenna@umkc.edu.

Editor/Writer: **Richard Delaware**

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