

Director: Richard Waring
Mathematics Coordinator: Richard Delaware

December 1, 1995

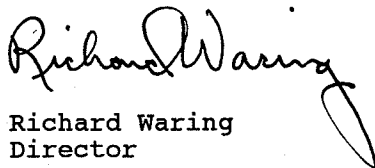
Vol. 10, No. 3

OPEN HOUSE THANK-YOU

Sixty-two individuals attended our 11th annual Open House on Nov. 5. Included were 43 parents and relatives of MPI students, 1 alumna, 23 students, and the entire MPI faculty and staff. This was a very good turnout since we had to compete with the Chiefs football game. 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!

[Wed. Jan 3, 1996]

CALL (816) 235-1272

A STUDENT FROM ERITREA

In the past, the MPI has been pleased to have several foreign students ranging from a Spanish Basque girl, to those from Turkey, Germany, South Africa, Laos, Cambodia, Vietnam, and Portugal. This year we have a student, Asmerom Tsegai at Van Horn High School, who is originally from the small, and new country of Eritrea, in eastern Africa. Eritrea only declared its independence from Ethiopia in 1991, became an official country on May 24, 1993, is slightly larger than, say, Ohio, and is home to about three million people.

Asmerom arrived in the US in 1990 with his mother, while war was raging in his country. After a year in New York, they moved to Missouri. He had previously lived in the Sudan, where he learned to speak Arabic. He also is fluent in English and Tigringa, the language of his tribe, also called by the same name. After surviving the rigors of the MPI, he plans to attend MU.

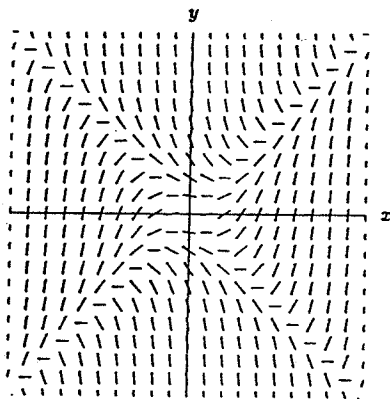
MATHEMATICS TECHNOLOGY REPORT

A TALE OF TWO CREDITS

1. New this year, as mentioned in the August issue, the Mathematics Coordinator has gathered all SHARP EL-9300C graphics calculator notes, techniques, and programs into a gold MPI manual, to join the other Calculus and (soon to be) Physics MPI Manuals. Students are much better informed with these in hand.

2. In September we upgraded Derive to version 3.06. Also, as reported in the October issue, we now have inkjet printers in our computer lab which produce professional-looking output, never jam, use standard paper, and are so quiet that we instructors have had to get used to not hearing when graphs are being printed!

3. In the second (calmer) year using our new calculus textbook, we finally have time to plan exercises on some mathematical topics well-suited to the presence of technology. One such topic is producing "slope fields" as numerical and visual solutions to simple differential equations of the form $dy/dx = f(x,y)$. Such a slope field is shown below:



$$\frac{dy}{dx} = x^2 - y^2$$

$$-4 \leq x \leq 4, \quad -4 \leq y \leq 4$$

4. The Mathematics Coordinator has written, now in its 3rd edition, a 10 page "Graphics Calculator Comparison Chart" available free to all. Compared are the best major graphics calculators on the market, namely the TI-82, TI-85, TI-92, HP 38G, HP 48G, HP 48GX, SHARP EL-9300C, and CASIO CFX-9800G.

E-mail received 10-10-95:

"Hi! This is ERIC HUSS from last year. I'm having a great time here at the UNIVERSITY OF ILLINOIS. However, the other day I received in the mail information on my transfer credit showing that I did not receive credit for the classes I took at UMKC. (Please send information on the Calculus) courses I took and whatever you might think is relevant. And if you could pass this same information on with Physics, I would appreciate that. This is extremely annoying, and the Office of Admissions are just ... Well, anyway their address is ...

Below I have attached the university's guidelines. These guidelines can be circumvented with information from you (hopefully).

[I. A college course taken by a high school student with a high school student population will not be awarded credit at UIUC...]

Sorry for the trouble. Hope you can help me out. If you can, please send me a message telling me how your year has gone so far.

Sorry for any typos... This is all very stupid. If you can send any information, I'd appreciate it...
Thanx."

E-mail sent 10-11-95 by the Mathematics Coordinator:

"Your school is not the only one to forbid college credit for courses made up entirely of high school students. [As in your guideline I.] I understand the reasoning, since many high schools offer calculus, etc. at their schools as either an AP course, or as "certified" by a local college, and the quality is often poor. Our program is distinctly different, fully accredited, and as you know, much harder. We should be an exception. If your registration people are willing to read a letter, with details of the program, or, would allow a recommendation from their own Mathematics and Physics Depts. (or ours, for that matter) to be accepted, then maybe they would allow you credit. I have had mixed

success with this strategy at other schools.

Let me know what you find out, and we'll do what we can, if they'll permit it. Sorry I couldn't be of more help."

E-mail received 10-11-95:

"Yes, I talked to them. They said if you would mail them a letter, they may be able to transfer the credit, despite the fact that the class was made up entirely of High School students. Hopefully with information on this "distinct" program they'll wake up and transfer my credit. Anything you can do would be greatly appreciated. Thank. Eric."

E-mail sent 10-12-95 by the Mathematics Coordinator:

"Eric: I put a letter in the mail today to the people you indicated. Let me know how it all turns out. [I've had to do this twice before, for Brigham Young University, and for Vanderbilt.]"

E-mail received 10-12-95:

"Thank you VERY much. I greatly appreciate it. I'll let you know how things go. Eric."

E-mail received 11-12-95:

"Well, I've finally found out that the UMKC MPI credit has transferred. Many thanks for the letter you sent. It is rather frustrating that they are so hard-bent against accepting outside credit, but I can see their viewpoint. Now if I can only get my Chemistry credit transferred... Thank you, again. I really appreciate it. Eric."

ODDS AND ENDS

Nov. 7 Jim Graczyk took several Van Horn High School students, including an MPI student, to the Univ. of Kansas' Engineering Day to compete in the Bridge - Building Design Contest.

On Nov. 9-10, Richard Waring traveled to Sarasota, FL to review for UMKC pre-professional programs of the New College of South Florida.

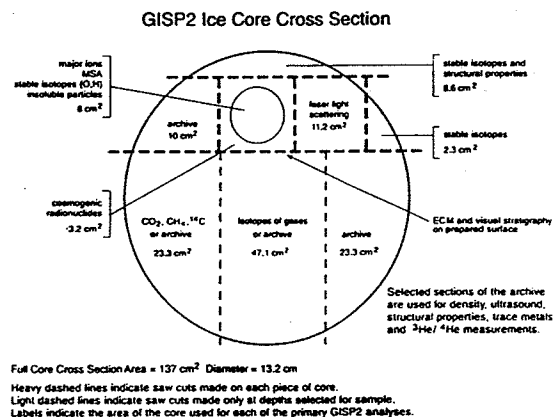
Nov. 20 we mailed to all parents or guardians of our current MPI students a letter with "MPI Christmas Gift Ideas", containing information about highly recommended graphics calculators and the mathematical software Derive.

Finally, we note, for our visiting alumni and friends, the continuing interior construction occurring in Room 207 where our enrichment speakers appear every two weeks. Nearly half this large room has now been walled off as a smaller room to house Paramedic classes beginning in January.

ENRICHMENTS

FOLLOW UP

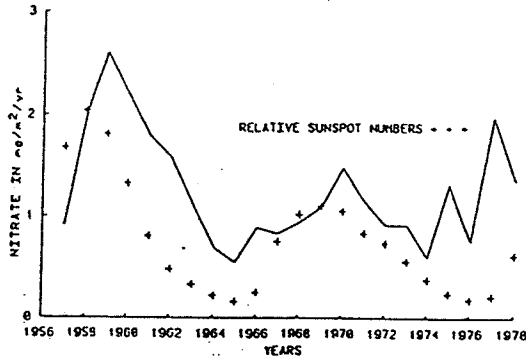
On Oct. 13, we welcomed for the first time Gisela Dreschhoff, a German Geophysicist and Deputy Director of the Radiation Physics Laboratory for the Space Technology Center at the University of Kansas, who spoke on: **A PALEO-ASTROPHYSICAL RECORD IN ICE CORES: NITRATES IN POLAR SNOW.**



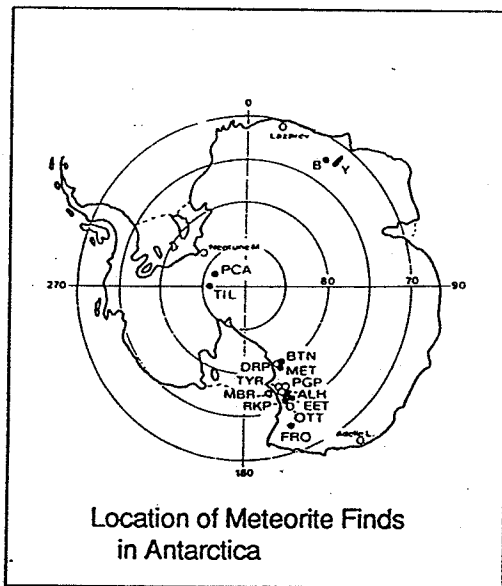
Some specific student comments were:

--Ms. Dreschhoff described her work on the history of solar flares for the last 500 years. To fulfill this objective, she has traveled with a team to Greenland and Antarctica. This was a wonderful presentation and ground-breaking research. The only improvement would be a field trip to Antarctica.

--She talked about how to use physics in a practical way and how to use what she had learned in her past education. She talked of her experiences in Antarctica and what she did to get the nitrate samples out of the ice cores. She had many different examples of how she was studying the effects of solar flares on the Earth.



--There are giant eruptions on the sun as large as the earth! When a large amount of charged particles are released by the eruptions, the radio waves here on earth are disrupted. There are brown-outs and black-outs as a result of these. Radiation after an eruption can kill an astronaut in space. NASA and the Air Force are collaborating in an effort to predict these things so nobody dies. That was truly intriguing. I enjoyed it IMMENSELY.



--Gisela studies the cycles of sun spots. She is sponsored by the Air Force. Sun spot cycles are important because a large one may break up radio waves and damage satellites. She had a slide of ice containing very old volcanic ash. She was a good speaker. What she said was interesting. The slide show was a nice way to break up the speech.

--She was very good, her films were interesting. You could compare graphs with what we did in class.

--Nothing could make this better. This stuff is cool--very enriching!

Oct. 27, Kathleen Fuller, a Physical Anthropologist, also from the University of Kansas, making her second appearance as an MPI speaker, discussed: **OUR SISTER TAXON: THE CHIMPANZEE.**

Students responded:

--Chimpanzees are apes, not monkeys. Orthograde posture is the tendency to hold the trunk up; they are capable of bipedal posture. Visual is more important than smell for primates. Primates have more flexibility and five fingers, pentadactyly. They have nails instead of claws. Different types of teeth allow primates to eat a wide variety of foods; they tend to have one offspring at a time. Primates have some instinct, but most action is learned. I think it is sad that high school students cannot deal with the introduction of an idea that is different from their own.

--She should bring an actual chimpanzee. Then we could visually see what she's talking about. If that's not sanitary, a stuffed chimpanzee toy would be OK.

--Ms. Fuller was an excellent speaker who gave a very enthusiastic speech on primates.

--Mrs. Fuller's presentation was based primarily on the evolution of humans and apes. She gave examples of how chimps and humans are similar based on research. For example, the hands of both primates are almost identical. Chimpanzees have nearly 1/3 less brain capacity than humans and both have similar vertebrae.



--Because of the profound close-mindedness and conservatism of suburban midwestern society outside of a university and set of classes, she needs to say she doesn't want to deal with the evolution/creation issue thing if she doesn't. Unfortunately, it seems we can't be expected to not respond to some perceived threat. Not a terrible amount of new information, but it was informative. Have her back if she would come back after our less than intelligent reception.

--Because of all the adaptations, primates are more flexible and can adapt to many different environments. The human and the chimpanzee are extremely similar in their DNA, this has led scientists to call chimps our "sister taxon".

--It was really interesting. She brought lots of overheads to show us the similarities between chimps and humans. Really neat and interesting.

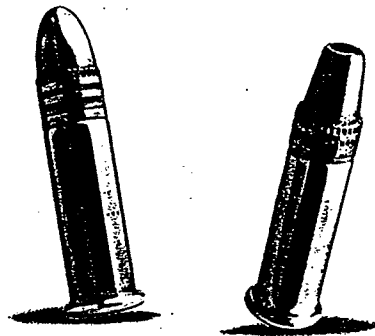
Frank Booth, a forensic chemist returning once more from the Kansas City Regional Crime Lab, spoke on Friday, Nov. 10 about **SCIENCE IN THE CRIME LAB**.

Students commented:

--He showed us that each bullet that is fired has distinct markings left by the barrel of the gun. He also showed us how the littlest things, like a partial shoe print or the ink on a letter, can be examined and used as a link to the suspect. Finally, he showed us that by putting a chemical on an area that used to have blood on it, the chemical would make the previously blood stained area illuminate, so they can make out shapes, like hand prints or foot prints. I think he gave away too many secrets of the trade. If we

have any criminal minds within our group, now they know exactly what to avoid when they kill someone.

--Using samples of hair under a microscope, crime lab workers can tell if the hair was torn, pulled, cut or worn. They can determine the reading on a speedometer at the time of a crash by the mark on it that needs UV rays to detect. UV rays also determine footprints and fingerprints. Plastic bags, pen ink, blood samples and soil samples have matches in patterns with those linked in crimes. Tire tracks are matched to tires, and blood patterns on walls can denote how a person was beaten. Luminal and DNA match blood w/blood of criminals. There are really no changes I would want to implement.



--I enjoyed the speaker. I feel isolated sometimes by all the biology we have in enrichment. I have done physics and chemistry - thanks for someone I'm interested in.

--The topic was excellent and he did a great job presenting the material. he kept us interested the whole time and the slides were very informative. The hands-on material was great and overall he did good!

--I was surprised at all the physics used for evidence.

--This guy was pretty good. Murder and crime investigating has always interested me. He explained how they pick up clues ordinary people wouldn't expect.

--This was a great and interesting enrichment. I learned a huge amount about the crime lab and the different departments and their jobs.

Wednesday, Nov. 22, we made our annual all-day field trip to the **NUCLEAR RESEARCH REACTOR** at the

University of Missouri - Columbia campus, and visited the MU Physics Dept.

Some student comments were:

--I can't really suggest any improvements. It was an amazing experience.

--We learned how the reactor makes objects radioactive. Topaz gem stones are made blue when exposed to neutrons. Small glass beads are made radioactive and put into a person's liver to help combat cancer.

--This visit was one of the best trips to a college that I have taken. I wish we could have gotten a little closer to the reactor, but oh well.

--The reactor at MU is used for research in fields from medicine to archeology. Objects are made radioactive by being placed within the reactor layers of beryllium and uranium. The closer to the core, the more radioactive the object becomes. Nuclear physics appears to be an interesting combination of chemistry, physics, and mathematics.

UPCOMING

On Dec. 8, our last enrichment date before Christmas Break, Ed Kiker, a Harvard graduate who majored in Lunar Geology, member of the National Space Society, and the CEO of Outer Space Industrial Resources Investigations Systems, will return to the MPI to speak on **OUTER SPACE AS A CHANGE-DRIVER**.

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

On Jan. 12, UMKC Physics Professor David Wieliczka will bring back his popular talk **LASERS AND HOLOGRAMS**.

Finally, for Jan. 26 our speaker is not yet confirmed.

NEW (OR CHANGED) MPI ALUMNI E-MAIL ADDRESSES

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

** CHANGES **

- (84-85) Brent Harding
brent@sed.stel.com
STERLING, VA
- (86-87) Pat Liang, MD
pwliang@aol.com, or
103052.2402@compuserve.com
SHAWNEE MISSION, KS

** NEW **

- (94-95) Jennifer Brown
brownjl@cctr.umkc.edu
UNIV OF MO - KANSAS CITY
- (94-95) Rachael Gard
c666277@showme.missouri.edu
UNIV OF MO - COLUMBIA
- (94-95) Eric Huss
e-huss@uiuc.edu
UNIV OF IL - URBANA
- (94-95) Hattie Williams
williamsh@cctr.umkc.edu
UNIV OF MO - KANSAS CITY

WE HEAR FROM PAST STUDENTS

RACHAEL GARD (94-95)
(Engineering Major)

E-mail received 10-6-95:

"Hello everyone. I've been meaning to write you for quite some time, but time has escaped me. How is everything going? I hope you're having as much fun making this year's class' lives miserable as you did with ours! (I'm just kidding...) Things are going okay at Mizzou. I study constantly, but nothing is new there. I must say you all prepared me well in that area.

I visited Nicole in Chicago last weekend, and Pipa was able to fly in. It was really nice to see them. Nicole is doing well at DePaul, and Pipa starts her university (in Portugal) this month. MPI was the topic of more than one of our conversations. Believe it or not, we actually miss studying together for calculus and physics. You guys kind of grew on us.

Well, I have a very long weekend of studying ahead of me, so I

should get started. I just wanted to keep in touch and see how everything was going. I miss you guys! Take care."

HATTIE WILLIAMS (94-95)
(Philosophy Major)

E-mail received 10-16-95:

"To all my friends at MPI: Salutations. How's life in your little corner of the world? Life's good, and I am happy to report that MPI did cover all my math requirements (except Stats., a psych. requirement). Yeah! I mean darn, no more fun math problems.

So how's technology? Did you guys get all the fun toys you wanted, calculators, handheld high tech, mini intergalactic quasiconverting derive 7.0 computers, or what was that? I bet that short-lived Windows '95 scare shook you up, but it seems we've moved on to bigger and better.

I'm in the honors program here at UMKC, and I'm thinking about joining Golden Key. I've been bid for Delta Z. Guess what, they expect me to memorize the Greek alphabet. C'est Chouette!

How did the presentation go with Mr. Graczyk? Well, I hope. I was wondering, are the budget cuts of the KCMO Magnet System affecting or will they be affecting MPI?

I have to close. I have other people to write to. Stay well."

JENNIFER BROWN (94-95)
(Foreign Language Major)

E-mail received 10-17-95:

"Hi! Guess who? It is Me your most favorite student from 94-95. So how is this year going? Are they as smart as we were or just smart-alecs? Anyway I just got the newsletter and thought that I would stop and say hello since I am attending UMKC. I still have no idea what to do with myself for the rest of my life, but I will eventually find something. Anyway I do not need another parking ticket so I must say goodbye."

MPI E-MAIL ADDRESS:

rdelaware@cctr.umkc.edu

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

MORE 1995-96 STUDENT IMPRESSIONS

"When I first came to the MPI I thought it was going to be easy (like High School). I realized I was going to have to study after the first couple of weeks. This is a lot harder than I thought it was going to be."

Greg Finke
Truman High School
Independence School District

"MPI has been really fun. I like the people and the teachers. I wish all of my classes were this fun. Even lectures aren't so bad. The work is sort of hard, but the teachers help us to understand."

Amanda Benavidez
Northeast High School
Kansas City, MO School District

"My first impression of the MPI was that it was going to be fairly easy. Once I passed the "class at 7 am every morning" hurdle, I found the information they were teaching to be a review. I thought, "Hey, this is not going to be all that bad." Boy, did I get a rude awakening! After the first "review" chapter was completed, the classes became much more difficult. I suddenly found that I had no idea what the teachers were lecturing about. Everything they were teaching was a completely new concept to me. I had to start thinking and applying logic to the word problems. I could no longer use just one equation for each problem. I now had to find many equations, rearrange them, combine them in different forms, then try applying them. It took me awhile to catch on, but now I think I have finally mastered the process, ... well, kind of.

Overall, I am glad I have the opportunity to take these MPI classes. They are a huge help in preparing me for college."

Julie Domsch
Lutheran High School
[Kansas City, MO School District]

"I really enjoy the challenge that MPI gives to me. Some people take easy classes all their high school careers and are satisfied with the easy A. Why not strive for the difficultly-attainable A? I believe things that are harder to get are worth more, and I also believe that a lower grade in a more difficult class is worth much more than a better grade in a much easier class. Most of the students attending MPI would probably agree with this idea. Even though we've been giving the greater effort, and still receiving lower grades, it's really satisfying to know that each of us are accomplishing college-level things a year ahead of expected and in addition to our high school studies. So, it's okay to feel a little satisfaction, but don't quit, because we still have three quarters left!"

Joe Ziolkowski
Van Horn High School
Kansas City, MO School District

A SOLUTION TO MATHEMATICS CHALLENGE #40

Recall the problem statement:

A computer printed out two numbers, 2^{1995} and 5^{1995} , completely multiplied out.

How many digits in all were printed?

[From: Quantum Magazine, Sept./Oct. 1995, p. 19.]

SOLUTION:

Suppose 2^{1995} consists of n digits, and 5^{1995} consists of m digits. Then

$$10^{n-1} < 2^{1995} < 10^n \quad \text{and}$$

$$10^{m-1} < 5^{1995} < 10^m .$$

[For example, with $2^5 = 32$, which has $n = 2$ digits, clearly $10^1 < 2^5 < 10^2$.] Multiplying the corresponding terms of these inequalities we get $10^{n+m-2} < 10^{1995} < 10^{n+m}$, so that $n+m-2 < 1995 < n+m$. But the only integer between these two outer numbers is $n+m-1$, meaning $n+m-1 = 1995$, so that $n+m = 1996 =$ the total number of digits that were printed.

A SOLUTION TO PHYSICS CHALLENGE #31

Recall the problem statement:

A ping-pong ball is tossed into the air. Will it take longer for it to go up, or to come back down?

[From: Quantum Magazine, Sept./Oct. 1995, p. 19.]

SOLUTION:

The tossed ping-pong ball, whether rising or falling, has to work against air resistance, and thus continuously loses mechanical energy.

So, the mechanical energy of the rising ball at any particular height is greater than the mechanical energy of the falling ball at that same height. Since mechanical energy = potential energy + kinetic energy, and the potential energy at any particular height is the same whether the ball is rising or falling, it follows that the kinetic energy and hence the speed of the ball at that height is greater when it is rising than when it is falling. So, the ping-pong ball takes longer to come down than it does to go up.

MATHEMATICS CHALLENGE #41

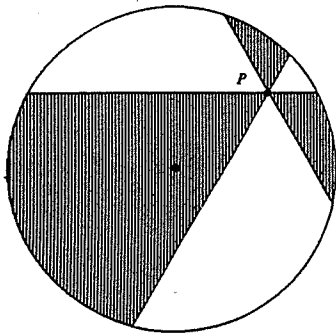
Let P be any point inside a circle, and draw three chords through P making six 60° angles at P . Color the six "pizza slices" alternately black and white, as shown below. This creates a 3-part white region, and a 3-part black region:

PHYSICS CHALLENGE #32

To the nearest power of 10, how many railroad cars will it take to reach across the United States?

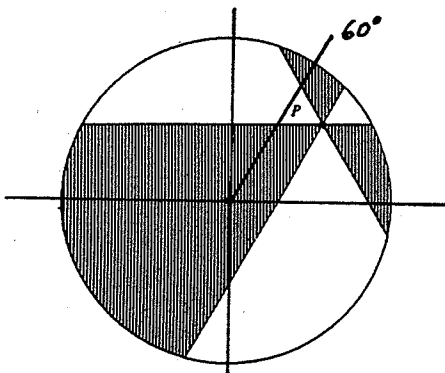
Editor/Writer: Richard Delaware

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'.



Prove that whichever 3-part region contains the center of the circle has the larger total area.

REMARK: To make this very specific, we can assume that the circle is the unit circle (radius 1) centered at the origin, that one of the chords through P is parallel to the x-axis, and that P lies in the region of the circle corresponding to the angles $0 \leq \theta < 60^\circ$, as shown below. [No generality is lost by any of these assumptions, because any other configuration can be rotated into one like this.]



[From: Mathematics Magazine, Oct. 1995, p. 312.]
