Mπ

The Mathematics and Physics Institute NEWSLETTER

Director: Jennifer Snyder
Associate Director: Richard Delaware

August 1, 2000 Vol. 15, No. 1

WELCOME TO YEAR 17

We welcome the 17th class to the MPI, representing 11 high schools: Blue Springs, Blue Springs South, Center Place Restoration, Fort Osage, Lutheran, Northeast, Paseo, St. Mary's, Truman, Van Horn, and Wm. Chrisman. We particularly want to welcome our first students from the Blue Springs District.

For the first time this year we offer a Calculus-based Physics course, to compliment our non-Calculus Physics.

MPI STUDENT ORIENTATION SEPT. 6-9, 2000

Each year the first three days at the MPI are spent in giving our students an overview of how we operate, a discussion of our policies on attendance, grading, etc., and two diagnostic tests. Time is then set aside for the instructors to informally 'get to know' their classes before we all become preoccupied with class work.

In particular, on the first day, Sept. 6, 2000, we'll provide each student with a packet of information and have each of them fill out a personal data form.

If you have any questions, call our MPI secretary, Suzanne, Mon-Thurs., 8:00am to 1:00pm, at 235-1272. We look forward to seeing our 17th class on **Wed., Sept. 6 at 7:00am in Room 207!**

STUDENTS PLEASE BRING:
ON SEPT. 6, 7 am, TO ROOM 207

- Your Social Security Number.
- $10.00 to rent a calculator.
- Your daily schedule of high school classes.
- Your schedule of extra-curricular activities.
- Your counselor's name.
- Ideas for Enrichment Speaker or topics.

MPI E-MAIL ADDRESS:

mpi@umkc.edu

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

MPI GRAPHICS CALCULATORS

The MPI requires ALL students to have and use a graphics calculator in both physics and calculus. For our purposes we have selected the **SHARP EL-9600**. Although the SHARP is not the most powerful graphics calculator on the market, it is ideally suited to the MPI and its selection of students. One unique feature, even in older models, is the ability to enter fractions and exponentials exactly as you would write them on paper. Some features are:

- Pen-touch screen entry option. [A plastic stylus is included.]
- TABLE feature.

- Up to 10 x-y functions for graphing, rather than 4.
- Unique Rapid Graph, Rapid Window, and Rapid Zoom features.
- Connects to a TI CBL (Calculator Based Lab).
- Sequence graphing.
- Split Screen option.
- More pixels for a finer screen resolution.
- Slide show feature.

All MPI students are required to rent a **SHARP EL-9600** from us, paying a $10.00 one-time non-refundable fee for the entire academic year, with an option to buy the calculator outright at any time [the full price, after the rental fee is deducted, is $60.00], OR, to provide themselves with an equal or better graphics calculator except for the TI-89, TI-92, and other calculators with computer algebra systems included. [Information, including cost, on calculators can be gotten from the MPI Associate Director by calling 235-1290.] Please note that MPI support and an MPI calculator manual will only be provided for the one calculator we rent.

The MPI-rented calculators will initially be loaded with a set of AAA batteries, but as these fail over the course of the year, student-renters are entirely responsible for buying and replacing them. (Our experience has been that at most one or two replacements are needed over the year.)

TO ALL MPI ALUMNI:

HAVE YOU GRADUATED FROM COLLEGE?

IF SO:
PLEASE CONSIDER BEING AN
-ENRICHMENT SPEAKER –

CALL 816-235-1272
Or 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)

2000 MPI AWARDS PRESENTATION AND TOP 10 MPI STUDENTS OF 1999-2000

Our final awards presentation was held on May 13, 2000, during which we were pleased to present many of our students with the following variety of awards. Also present were administrators, parents and Steve Scott, principal of Fort Osage High School.

CALCULUS I

NAME		SCHOOL
Heather	Biggs	Wm. Chrisman
Brad	Carrow	Ft. Osage
Tri	Do	Northeast
Reshawn	Fields	Paseo
Melinda	Hacker	Truman
John	Hershberger	Ft. Osage
Thao	Huynh	Van Horn
Nathan	Johnson	Truman
Jeremy	Knoll	Paseo
Matthew	Lane	Truman
Lyndsey	Main	Wm. Chrisman
Joe	Moccia	Paseo
Cassy	Pallo	Truman
Sarah	Piatt	Center Place Restoration
Andrew	Schmidt	Hope Christian
Sam	Slee	Truman
Sarah	Smith	Paseo
Amanda	Thatch	Paseo
Seth	Watson	Truman
Ryan	Williams	Truman
Rachel	Yeargin	Truman

CALCULUS I & II

NAME	SCHOOL
Megan MacDonald	Truman
Cassy Pallo	Truman
Rachel Yeargin	Truman

PHYSICS

NAME		SCHOOL
Heather	Biggs	Wm. Chrisman
James	Cameron	Ft. Osage
Brad	Carrow	Ft. Osage
Tri	Do	Northeast
Reshawn	Fields	Paseo
Melinda	Hacker	Truman
John	Hershberger	Ft. Osage
Thao	Huynh	Van Horn
Nathan	Johnson	Truman
Jeremy	Knoll	Paseo
Matthew	Lane	Truman
Megan	MacDonald	Truman
Lyndsey	Main	Wm. Chrisman
Joe	Moccia	Paseo
Cassy	Pallo	Truman
Sarah	Piatt	Center Place Restoration
Andrew	Schmidt	Hope Christian
Sam	Slee	Truman
Sarah	Smith	Paseo
Amanda	Thatch	Paseo
Seth	Watson	Truman
Ryan	Williams	Truman
Rachel	Yeargin	Truman

We also honored the **TOP TEN** students (ranked according to the mean of their full-year college calculus and physics grades) by giving them a one year subscription to **Scientific American Magazine** and a copy of **"What's Happening in the Mathematical Sciences."**

RANK	NAME	SCHOOL
1	Sam Slee	Truman
2	Megan MacDonald	Truman
3	Amanda Thatch	Paseo
4	Matthew Lane	Truman
5	Sarah Smith	Paseo
6	Ryan Williams	Truman
7	John Hershberger	Ft. Osage
8	Andrew Schmidt	Hope Christian
9	Cassy Pallo	Truman
10	Joe Moccia	Paseo

Finally, we list those MPI students planning to attend UMKC who received various scholarships from UMKC; included are those students to whom the MPI awarded Chancellor's Scholarships:

UMKC Chancellor's Award Winners:

Herber Hernandez	Northeast
Tri Do	Northeast
Nikunj Bhakta	Northeast

UM Curators Award Winners:

Brad Carrow	Ft. Osage
Sarah Piatt	Center Place Restoration
Matthew Lane	Truman
Ryan Williams	Truman
John Hershberger	Ft. Osage

ADVICE TO STUDENTS OF YEAR 17 FROM THE STUDENTS OF YEAR 16

At the end of this last year, in May, we decided once again to have our students write whatever they wanted in answer to the question:

"What ADVICE would you give to incoming students about study, attitude, or any other aspect of surviving the MPI in 2000-2001?"

We were pleased at how seriously and with what maturity they wrote, and so each incoming student will receive a complete set of these words of advice from the students of Year 16. Here are some excerpts from that document.

"No matter what you think, high school does not prepare you for college. But MPI opens your eyes and gives you a hint of what your future holds. I'm sure most students who attend MPI are going on to college, so really make good use of your time.

- See when you work well (mornings, afternoons, evenings, 3am?) so you can get a lot done.
- Try to turn in everything. When a lab is worth 50 points, 9 points might not seem like much, but it helps...believe me!
- Along with turning in your work, try to complete it. TIME MANAGEMENT is the most important thing at MPI.
- Go to enrichments. It's actually worth 5% of your calculus grade. I REPEAT, it is 5% of your calculus grade!
- And if you're feeling down, go downstairs to the commons area and buy a Coke. Or you can always get candy from Suzanne."

Melinda Hacker
Truman High School

"Nobody can pass classes at MPI if they don't have at least two hours to study every night. Besides that, also expect to do homework and work on problem-solving. This is the only way you can get on top of everything and do well at MPI. Is it that difficult? Yes, but there are still MPI professors and your high school teachers always there to help you. Don't give up when you feel things are difficult. If you don't understand, read your book over and ask

your professors. Remember one thing; try your very best to take advantage of all knowledge. Good luck!

Tri Do
Northeast High School

"The most important thing is to stay on top of things. Never slack off when you don't have a good understanding of what's going on. In the beginning, you're going to be studying for three hours every night. Don't worry! It does let off after awhile as your test taking skills get better and your studying becomes efficient. When that finally happens, you feel so smart, it's amazing! There's nothing better than getting an A on one of Delaware's exams. (By the way, don't be shocked on the first one when you get an 18/100!) So hang in there...you can't work too many hours or take the lead in the school play but, believe me, once you're on the other side, it's definitely worth it!"

Sarah Smith
Paseo Academy

"Study vigorously for the Calculus exams or they'll eat you alive! I also strongly suggest attending the after-school study periods before each exam. The teachers are there to help you understand so ask the questions on your mind!"

Brad Carrow
Ft. Osage High School

"Don't take the suggested homework lightly. It will help you learn the subject matter. Also, don't waste your time in problem-solving because when used properly, it is extremely helpful."

Nathan Johnson
Truman High School

"MPI can be fun and easy, or it can be difficult and confusing. It's your choice. Do the homework and turn it in on time. If you don't, you will find yourself falling behind MPI's fast-paced schedule. Don't procrastinate about completing your labs, and be sure to turn in your pre-lab write-ups. They are not difficult and they are worth 10 points. "Hah!", you say! "Ten points?!" Trust me, once the labs get harder, you'll be glad for a measly ten points. Have fun and enjoy yourself. Admit that you're a nerd; you wouldn't be here if you weren't. Enjoy the beauty of math and science; it's fantastic once you realize that you understand what an integral is and you know how to solve it. Call Mr. Delaware late the night before a test and beg him to have mercy and to explain integration with the chain rule one more time. Above all, have confidence in yourself and don't give up."

Sarah Piatt
Center Place Restoration School

"MPI will feel like math boot camp for the first two months or so. After the math assimilates itself into your brain, the world around you will begin to look amazingly different until you can almost see the delicate balance of numbers dancing throughout reality.

Make sure you have people to study with! It's very important to share ideas. And what better dinner conversation than, "Okay, so how do you find the integral from negative four to positive four in the line created by x^2tanx?...Pass me the butter please." Plus, if you're going to give up your time to math and stuff your brain 'til it's bursting, you may as well have someone to complain about it with...you know...to help ease the pain.

MPI will change your thought processes for the better (efficiency-wise). I was afraid of what MPI would do to me, but now I'm glad that I've done it. I've grown so much! MPI will give you what you put into it, and it will also give you the grade based on how much you put into it.

Good luck! Enjoy yourself! Don't be afraid to ask questions! You can do it! Don't give up!"

Jeremy Knoll
Paseo Academy

"To survive MPI you really need two things; self-awareness and determination. You have to know yourself and know how your brain works. Trust yourself. If you don't think that you have to go through any more homework problems to grasp the concept, don't! It's not high school – there are no teachers looking over your shoulder. However, you must be willing to recognize when you are weak in a certain area. Then you must be willing to work to fix the problem by a lot of studying and practice.

You also have to adjust your lifestyle to early classes. You have to go to bed earlier than your peers. All of this may sound overwhelming, but it's easy once you make it common habit. MPI is a great opportunity. Think of all the students in third world countries who would kill for such an educational program. It's challenging, but the rewards are outstanding. Getting through the courses is possible, if not likely...I'm living proof."

Lyndsey Main
Wm. Chrisman High School

"Where do I begin? The fact that I'm here writing this, actually on the other side of the long MPI tunnel is something I couldn't imagine at the beginning of the year. Take it from me; your previous troubles with math do not matter. Just work hard. You may work harder here than you have ever worked before. Get with a study group. You will all help each other justify the hard work you are doing. You will emerge from these courses profoundly changed and you will be grateful. I promise you that it gets easier after a few months. The teachers here want to see only perseverance, and you will be rewarded with a lot of interesting knowledge and preparedness for college studies. Good luck! Remember, it gets easier!"

Joe Moccia
Paseo Academy

"In order to survive MPI you must have determination, and you must dedicate at least two to three or more hours to study for MPI. I advise that you do something everyday; homework, study and review. Be ready to explore a new world where you have to be focused and where laziness will not do it.

To tell you the truth, I had a hard time at the beginning of the year. Why? Merely because I thought MPI was just another high school course, but I was wrong. MPI is very serious in everything you do. MPI goes by fast so organize yourself pretty well before you are left behind.

Finally, don't be nervous about it; just work hard, try to understand it, and don't leave your assignments until the day before they are due. Also, don't think that you can't have fun, because you can! Get ready for a busy school year!"

Herber Hernandez
Northeast High School

"The most important thing I learned at MPI is to study, manage your time and don't give up. Spend time on practice and come to class everyday."

Thao Huynh
Van Horn High School

"Don't get discouraged about MPI. It is a big obstacle, but you can overcome it. Also, be prepared to climb all those stairs (59 to be exact). Take your studying seriously, and do your assignments. Look over the suggested problems in Calculus. Be prepared for unexpected grades on your tests. Good luck and I hope you survive!"

Heather Biggs
Wm. Chrisman High School

THE 2000-2001 CLASS (TO DATE)

Section A (17)

NAME		SCHOOL
Aaron	Ballantyne	Center Place Restoration
Aldul	Bangura	Northeast
Donald	Engle	Wm. Chrisman
Nehemiah	Hanson	Ft. Osage
Erika	Helm	Truman
Allen	Holloway	Ft. Osage
Nina	Lan Franca	Truman
Leslie	Palmer	Truman
Brad	Patton	Wm. Chrisman
Vy	Pham	Northeast
Paul	Premoe	Center Place Restoration
Daniel	Smith	Wm. Chrisman
Adam	Stickley	Truman
Gieselle	Taylor	Paseo
Nathan	Wagner	Blue Springs
Susan	Williams	Van Horn
Tristan	Wilson	Wm. Chrisman

Section B (18)

NAME		SCHOOL
Lori	Alvis	Ft. Osage
Tim	Fortner	Wm. Chrisman
Matthew	Garr	Ft. Osage
Charles	Hood	Northeast
Chris	Kidd	Center Place Restoration
Wyeth	Killip	Truman
Jennifer	Landry	Van Horn
Melinda	Musil	Truman
Loc	Nguyen	Northeast
Tu	Nguyen	Northeast
Heather	Palmer	Truman
Josh	Palmer	Truman
Ben	Rector	Van Horn
Kurt	Richter	Wm. Chrisman
Megan	Roney	Truman
David	Smith	Truman
Michelle	Warrington	Wm. Chrisman
Brian	Woodward	Truman

Section C (16)

NAME		SCHOOL
Chris	Allen	Truman
Michael	Bowerman	Ft. Osage
Kevin	Canning	Ft. Osage
Christopher	Dawson	Truman
Scott	Domsch	Lutheran
Mike	Farrell	Ft. Osage
Billy	Gooch	Ft. Osage
Chris	Gordon	St. Mary's
Laura	Hajj	Ft. Osage
Patrick	Hansen	Blue Springs South
Lyndsey	Kleyh	Wm. Chrisman
Emal	Latifzai	Wm. Chrisman
Christopher	Moore	Truman
Kevin	Tisdale	Blue Springs South
Luke	Whorton	Truman
Jason	Wooster	Wm. Chrisman

Section D (17)

NAME		SCHOOL
Jared	Allen	Truman
Josh	Bergsten	Truman
Jamie	Chapman	Truman
Jesse	Chapman	Paseo
Kate	DeWalt	Paseo
Kyle	Dieckmann	Ft. Osage
Anthony	Gunsaulis	Ft. Osage
Jordan	Gwinn	Wm. Chrisman
Stephanie	Kelley	Wm. Chrisman
Josh	Martin	Truman
LaTisha	Parker	Northeast
Thuong	Phan	Northeast
Allison	Scott	Center Place Restoration
Charles	Smith	Wm. Chrisman
Sinh	Vu	Northeast
John	Waldman	Ft. Osage
Mary	Williams	Truman

These are the total of 68 students (as of this newsletter) who will be enrolled. As usual, there will be additions and deletions through September.

THE 2000-2001 STAFF

In PHYSICS:

Larry Harding (retired), from Fort Osage, a UMKC Physics **Undergraduate Student**, with some assistance from our liaison **Roy Cook** of Northeast,

And, in CALCULUS:

Sheri Adams from Truman, and **Libbi Sparks** from William Chrisman.

Our University staff is listed in the heading of this newsletter, and our half-time secretary and assistant is **Suzanne MacDonald**.

MPI T-SHIRTS!

Beginning in about October, we will once again be selling MPI T-shirts and sweatshirts to our students. These shirts have a classy 3D graph ($z = \cos x \cdot \sin y$) on the back and our student-designed MPI logo on the left front.

ENRICHMENTS

FOLLOW UP

On **April 14** Lori Hill, an Electrical Engineer and General Manager for Flight Safety Systems, Business & General Aviation, at Honeywell, spoke on **GPS IN THE WORLD OF AVIATION.**

Student comments were:

■ Lori Hill started as Physics tutor for MPI in 1985. At first she was a Design Engineer working on non-nuclear parts of nuclear weapons. When nuclear funding began being cut, she moved into aviation, designing tracking systems, etc. She has now moved from actually building the part to running a business around these parts. She explained the different equipment used in navigation.

■ The GPS's were really interesting. I also never thought that the pilot used lots of maps, and I had no clue how hard it was to fly a plane.

■ I liked this enrichment. Now I have more knowledge about the workings of an airplane; I always used to wonder.

■ GPS is pretty darn cool!

■ I think Lori did a great job at making everything fresh and attention-grabbing as possible.

On **April 28** Tom Huffman of the National Space Society, spoke on **NANOTECHNOLOGY**.

Students responded:

■ Tom talked a little about himself. He wanted to be part of NASA, but changed his major to nanotechnology. Nanotechnology is using things at a billionth. He talked about how IBM spelled it's name on atoms. He also talked about how we used to work with things on a micro-level and how we are now working on a more precise nano-level.

■ It's really an interesting topic. It's something that the world is talking about more today. I find it amazing how much our technology has grown and what we are now able to do. It's almost scarey to think about what our future will hold. His presentation reminded me how close we are to becoming Huxley's Brave New World. I can only imagine what the future will hold.

■ I liked this enrichment. The study of nanotechnology is very interesting and useful. I'm waiting to see the revolution of nanotechnology.

Continued after the Calendar →

Mathematics and Physics Institute

CALENDAR 2000-2001

YEAR 17

MPI Begins	Wed., September 6, 2000
1st. Quarter Grade and Probation Reports Sent	Mon., October 30, 2000
MPI OPEN HOUSE for Parents/Teachers/etc.	Sunday, November 5, 2000
Thanksgiving Holiday	November 23-24, 2000
Christmas Holiday	Thurs.-Mon., December 21, 2000-January 1, 2001
MPI Classes Resume	Tues., January 2, 2001
PANEL DISCUSSION & REUNION	Wed., January 3, 2001
Final Exam – Calculus I - (Math C Only)	Wed., January 10, 2001
2nd Quarter/1st Semester Grade Reports Sent	Thurs., January 11, 2001
Martin Luther King Holiday	Mon., January 15, 2001
President's Day Holiday	Mon., February 19, 2001
3rd. Quarter Grade Reports Sent	Tues., March 20, 2001
MPI Spring Break	Mon.-Fri., April 9-13, 2001
MPI Classes Resume	Mon., April 16, 2001
Final Exams – Calculus I (A,B,D) and Calculus II (C Only)	Mon., May 7, 2001
Final Exam – Physics	Tues., May 8, 2001
MPI Breakfast	Wed., May 9, 2001
MPI Awards Presentation/Last Day of MPI Classes	Thurs., May 10, 2001

UPCOMING ENRICHMENTS

One of the special features of the MPI is its biweekly enrichment series, in which on alternate Fridays either professionals in the sciences, engineering, mathematics, etc., speak to our MPI students, or , we take a field trip to such places as Linda Hall Library of Engineering, Science, and Technology, UMKC's Physics Department, or Worlds of Fun for some 'hands on' physics.

As part of our early MPI orientation, Debra Gaggens of UMKC, will speak on Sept. 8th, about college admissions in general, and the importance of thinking about applications EARLY. (This is not intended to be a recruitment for UMKC, but a general discussion to help sensitize our students to the importance for colleges of deadlines.)

On Friday, **Sept. 22nd** , Lori Hill, an Electrical Engineer, former General Manager for Flight Safety Systems at Honeywell, and now Director of Broad Band at Sprint, will speak on **High Speed Internet**.

The October 1 newsletter will report on those speakers scheduled for October and beyond.

TO THE PARENTS OF THE 2000-2001 CLASS AT MPI

This newsletter is written for **YOUR** information, and there will be one sent to you every two months during this year, while your son or daughter is at the MPI.

We firmly believe that without your support and concern at home, students cannot succeed in such a rigorous program as the MPI. Our classes are NOT high school classes and require both study skills and a commitment that students still in high school, however talented, have not experienced before. In both of these areas YOU as parents can be of enormous help.

One of the first facts we have learned to face in the last sixteen years is that many bright students never learn to study efficiently; they have often gotten along very well with a 'wait and cram' attitude, giving textbooks only an occasional cursory look in time for testing and relying on their innate ability to absorb information and skills in the classroom. However, in coming to the MPI, these same students always find themselves at first, and suddenly, falling behind.

In general, in college classes **MORE MATERIAL** is covered, and **MORE SKILL** with concepts is required, i.e., **THINKING** is expected regularly. This comes as a shock to many talented students. One of the MPI's goals is to expose students to this shock, and help them overcome it by learning effective study skills in actual practice. But **YOU** as parents can help this transition enormously by suggesting that your children actually spend the minimum of one hour per subject, per night of study that we here at MPI urge. They must come to realize that longer study times reflect the new rigor of the COURSES, not their lack of talent. This is a point of view that many students find hard to accept at first. Your encouragement can help them over the hump. Encourage them to seek the help of all the teachers involved in the program and to put aside the false idea that only remedial students need to TALK about mathematics and physics. The fact is that true understanding comes only from learning to discuss and explain a subject, and this is ESPECIALLY SO in physics and mathematics.

Finally, we urge you to call us if you ever have a question, and we hope that you will find time to visit the MPI during our **OPEN HOUSE** on **Sunday afternoon, November 5, 2000.** (See the Calendar in this issue; more about this in the October newsletter.)

WE HEAR FROM PAST STUDENTS

Jeleania Fields (94-95)
Mathematics Major
Oakwood College

"As a senior in college, I'm still "learning" things that were taught at MPI. Study habits!!! I cannot express how attending MPI helped me to develop what kept me ahead all through my college experience. READ!!! READ!!! and UNDERSTAND!!! Before a test especially!!! I learned to create a network of fellow students to have to study with and call in case I get stuck somewhere in a particular problem. I learned how to adjust to a diverse classroom. I appreciate the friendships that I developed with many other students of different cultures than myself. I got a taste of college that woke me up, and made me realize how "unprepared" I was for college. It also looks nice on a resume."

Sarah Thompson (96-97)
Atmospheric Science Major
University of Missouri - Columbia

"The MPI instructors are definitely more concerned with how well the students learn the material. MPI has really helped me out. When I took Calc II, the first couple weeks' worth of material was all review for me, because I'd learned it in MPI Calculus I. When I took Calc-based Physics, my Physics knowledge from MPI was also advantageous for me. MPI was great! I'd recommend it for any serious student, especially those who plan to go into science or math-based fields."

Brent Thompson (97-98)
Electrical Engineering Major
University of Missouri - Rolla

"I would have to say that the MPI courses were of better quality than those I've taken at Rolla. The classes at MPI were much smaller and were always taught by instructors instead of T.A.'s. By particiapting in the MPI, I was able to gain some valuable insight on what is expected in a college course. Keep up the good work!"

Dianne Le (97-98)
Journalism Major
University of Kansas

"The MPI is a wonderful program that is greatly needed for high school students, especially in the KCMO School District. It gives students who want to pursue a high education a taste of the workload in college, as well as letting students compete with others like themselves, in academics. It would add to the success of MPI if students were able to visit other colleges as a field trip or so. I'm glad I got the chance to be in the MPI!"

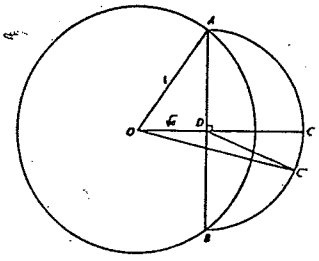
Alicia Siy (97-98)
International Business Major
University of Missouri - Columbia

"The small classroom setting at MPI was essential in helping me learn difficult concepts. Teachers were always available for extra help. The "high school" setting made it easier to approach teachers with questions and the "college" setting prepared me for things to come. Being able to form good study habits (e.g. group study sessions, a study system, etc.) during high school was helpful. I have been able to save a lot of time and money having graduated from the MPI program. Also, having teachers from the high schools is great because it helps the students form relationships so it is easier to approach them for help. The tests are really difficult, but they are exactly what it's like in college. Having a curve is a great thing to do so as not to hurt the grades of the students brave enough to face the challenge of MPI."

A SOLUTION TO MATHEMATICS CHALLENGE #63

Recall the problem statement:

A semicircle is drawn outwardly on chord AB of the circle with center O and radius 1. The point C on this semicircle which "sticks out the farthest" from the given circle lies on the radius ODC which is perpendicular to AB, because for any other point on the semicircle, we have OC'<OD+DC'= OD+DC = OC. Of course, the exact size of OC depends on the choice of the chord AB.



FIND the length of chord AB, so that OC has maximum length.

SOLUTION:

To maximize OC it suffices to maximize OC^2. For convenience, let $OD = \sqrt{a}$. Then $OD^2 = a$, and applying the Pythagorean Theorem to triangle AOD, the radius of the semicircle is $AD = \sqrt{(1-a)} = DC$. Thus,

$$\begin{aligned} OC^2 &= (OD + DC)^2 \\ &= (\sqrt{a} + \sqrt{(1-a)})^2 \\ &= a + 2\sqrt{(a(1-a))} + 1 - a \\ &= 1 + 2\sqrt{(a(1-a))}. \end{aligned}$$

For OC^2 to be maximum, the value of $a(1-a)$ must be a maximum. Since

$$\begin{aligned} a(1-a) &= a-a^2 \\ &= \tfrac{1}{4} - (a-1/2)^2 \end{aligned}$$

we see that $a(1-a)$ is maximum when $a = \tfrac{1}{2}$. Hence, $AD = \sqrt{(1-a)} = \sqrt{(1-1/2)} = \sqrt{2}/2$. So the length of the

chord AB, so that OC has maximum length is AB = 2AD = $\sqrt{2}$.

Observe also that triangle AOB thus has sides 1, 1, and $\sqrt{2}$, meaning AB subtends a right angle at the center O.

A SOLUTION TO PHYSICS CHALLENGE #54

Recall the problem statement:

Suppose you have just made a hot cup of coffee, but you've still got 5 minutes until class. If you want to bring your coffee to class as hot as possible, should you put the cream (cold) in now or just before class? When should you add the sugar?

SOLUTION:

This is the type of question that the physics community likes to debate. From time to time, articles will appear in "The Physics Teacher" on this question. I will give you my answer, but if you would like to present your own, please send it in!

If you want your coffee to be as hot as possible just when your class begins, you should add the cream at the last possible moment because it will cool the coffee down. That might seem pretty clear, but what about the sugar? You should add the sugar at the last minute as well because adding the sugar will also cool the coffee down. The important thing about the sugar isn't the temperature of the sugar, but the fact that it takes energy to dissolve into your coffee. This energy must come from the coffee itself and will reduce the temperature. There are other things to think about as well. To stir or not to stir? Stirring your coffee also cools it down because it brings the warmer coffee at the bottom and center to the top and sides where heat will be conducted out of the liquid. Stirring does this much faster than the convection currents in coffee would. There are also issues with what kind of spoon to use, how dark your coffee is, and what color cup to use. If you are a coffee drinker, do some experimenting and see what you think is best!

MATHEMATICS CHALLENGE #64

Three neighbors contributed $4.00 each and bought a ham (without skin, fat, or bones). One of them divided it into three parts asserting that the weights were equal. The second neighbor said she trusted only the scale at the local shop. There, it appeared that the parts, supposed to be equal, corresponded to the monetary values of $3.00, $4.00, and $5.00, respectively. The third neighbor decided to weigh the parts on her home scale, which gave yet another different result. This led to a quarrel about who should get which part.

Explain how it is possible to settle this dispute and to distribute these three parts (without dividing them again) in such a way that each woman would have to admit that she had got at least $4.00 worth of ham, if computed according to the scale which she trusted.

[From: One Hundred Problems in Elementary Mathematics, by Hugo Steinhaus, 1964, Dover, Problem #49, p.25.]

PHYSICS CHALLENGE #55

Since we are talking about coffee: As you stir instant cream or instant coffee (or Kool-aid!) into a cup of water, tap the side with your spoon. The pitch of the tapping changes radically as the powder is added and then during the stirring. Why?

Tap the side of a glass of beer (but drink it **only** if you are over 21) as the head goes down. Again the pitch changes. Why?

You may have a tendency to answer that the foam or the powder dampen the oscillations caused by the tapping, but even if that is true, would that change the pitch or only the amplitude?

(Adapted from: Walker, J. (1977). Flying Circus of Physics. New York: Wiley & Sons, Inc.)

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.

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