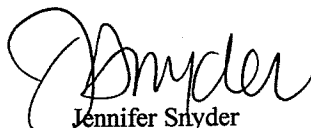## OPEN HOUSE THANK YOU

We had an excellent turnout for the MPI Open House this year. There were 60 people who attended the November 7th event. A total of 22 MPI students and 7 staff, greeted the 29 parents and family and 3 school administrators, and presented demonstrations and lab activities from both physics and mathematics. I want to thank everyone who attended for taking time out of your busy schedules to attend the Open House. I feel that the students did a fantastic job of displaying what they've learned so far at MPI.

Also, I would particularly like to thank the parents for attending. It was very encouraging to see such a nice turnout. It indicates that you are involved in your son's or daughter's education which is essential for their success both here at MPI and in future years.

We realize that the demands and expectations at MPI may be a new experience for your son or daughter. Although we want everyone to have a solid foundation in physics and mathematics, the real goal of the MPI is to help the student develop good study habits, reasoning abilities, and problem solving skills, which are essential to continued success in mathematics and physics in the future.

If you have any questions about MPI or about your son or daughter, please feel free to call.

Jennifer Snyder
Director

To all MPI Alumni:
You're Invited to the Annual

MPI REUNION
&
ALUMNI PANEL
DISCUSSION

Tuesday, January 4, 2000
7:00-8:45a.m.
Here at the MPI, Room 207
Come & Visit Old Friends
& (Even Older) Teachers!

Would You Like to

Be on the Panel?
Call (816-235-1290)
or Email: mpi@umkc.edu

WE LOOK FORWARD
TO SEEING
YOU!!!

ODDS AND ENDS

On **October 15.** the following flyer was mailed to all mathematics and science teachers, counselors and others at both Blue Springs District High Schools:

On **October 26,** Jennifer Snyder and Richard Delaware met with the UMKC Dean of Arts and Sciences James Durig, Fort Osage Superintendent Paul James (recently named Missouri Superintendent of the Year), and new Independence Superintendent David Rock to present our annual MPI Year-End Report.

On **December 3,** Richard Delaware will give a talk in the UMKC Department of Mathematics & Statistics Expository Talks Series Entitled: "Kissing Numbers: How Many Congruent Polygons Can Kiss Another of Their Kind?" [This talk was previously given on **November 30** at Benedictine College in Atchison.]

Around **December 13,** if the doctors are correct, MPI Calculus Instructor Libbi Sparks will give birth to her second child. We wish her well!

MATHEMATICS TECHNOLOGY REPORT

1. In October we surveyed 47 current Year 16 MPI students about their **off-campus computer access.** The results were as follows:

   38 (81%) have computers.
   40 (85%) access Internet sites, and
   26 (55%) access daily or weekly.
   36 (77%) have e-mail addresses.

   Of those 38 computers:

   32/38 (84%) run Windows 95, 98, or NT
   35/38 (92%) are located at students' own homes
   36/38 (95%) have an Internet connection

   All but one of these percentages have risen anywhere from 1% to 27% since last year.

2. On a **Writing Assignment in Calculus,** a technology question was posed:

   "Explain the mystery of why your calculator fails to graph $f(x)=(1+1/x)^x$ for x between -1 and 0. For instance, -1/3 is in that interval, and $f(-1/3) = (-2)^{-1/3}$, approximately -.79. Why doesn't this or any other point seem to graph?"

   Can you explain why?

   [There's a good mathematical reason for part of this. **An Answer** appears on the last page of this issue.]

ENRICHMENTS

FOLLOW UP

On Friday, **October 1,** Tony Thornton (MPI 88-89) a Network Design Engineer working on Broadband Operating System Development for Sprint spoke on **A CAREER PATH: MPI TO SPRINT.**

Students responded:

■ The presentation was pretty good overall. The packet was a good idea so that we can follow along and look back at it later.

■ I think Tony is a good story teller, and I would have liked to hear more personal anecdotes to illustrate the suggestions he was making.

■ He did an excellent job relating to the students.

■ The only changes that should be made are in the beginning, when he starts the presentation. After that I think everything was alright. I kind of liked the presentation, but I am not interested in becoming an engineer.

■ Well, I liked this enrichment. Mr. Tony Thornton gave us experiences about education, career. One thing I feel sorry that was the time of the enrichment was too short; that was not enough time for an enrichment because I think we would have a lot of things to ask and the speaker also would have a lot more things he wants to say.

■ Mr. Thornton made me more interested in Sprint, and I am going to log onto their web site and send them a resume for an opportunity at an internship.

■ I thought that Thornton did a very good job of staying on subject and answering the questions asked. Considering the topic, I think he touched every applicable subject for the right amount of time.

On Friday, **October 15,** James Case, a medical physicist at Cardiovascular Consultants, spoke on **SO YOU WANT TO BE A SCIENTIST?**

Students commented:

■ He did a very good job and presented many points and facts; "determination is the key."

■ I think he was a good speaker.

■ Mr. Case had a lot of information to tell us about and a lot of it I found very helpful. The packet that he gave us will help me remember parts of his presentation later on throughout the weekend and if I need to refer back to something he said, then it's right there.

■ Very informative and relevant matter to our age group. He spoke well and I'm glad I got to hear what he had to say.

On Friday, **October 29,** Jim MacDonald, an On-Scene Coordinator for the U.S. Environmental Protection Agency spoke on **EPA: EMERGENCY RESPONSE.**

Students responded:

■ The speaker did really well with his descriptions, visual aids, clarity and interaction with the students.

■ I liked that he told us you can test chemicals and see what happens; how the chemical is dangerous to people; when we use too much of the chemical in our body, we can be killed.

■ His performance was great as well as his video. He brought to our attention facts about chemicals. Mr. MacDonald explained to us the levels of personal protection equipment. He was very informative about what he does and was humorous as well as serious at some points.

■ I thought that this material was really interesting. I had no idea what was in Meth. It's disgusting! I'm surprised the chemicals don't kill someone on the spot.

■ I think it was the most interesting enrichment yet. Very hands on, no slide show or overhead. I liked it!

■ Let someone wear the sealed suit for Halloween!

■ The "poison" sticker is now appropriately affixed on my MPI notebook.

On Friday, **November 12,** paleontologist and dinosaur hunter Craig Sundell of KU spoke on **THE REAL JURASSIC PARK: A WINDOW INTO PALEOECOLOGY.** He was joined by

former MPI student **Tim Parker (91-92)**, known on the dig site as the "Plaster Master."

Students commented:

■   I liked his clothes because he looked like the cliché of a paleontologist. I liked that he was vocal and bold, he was easy to understand, exciting.

■   His speech was great; he had a loud voice so that everyone had a chance to hear what he was talking about. At times he was serious and at times he was humorous, therefore making us learn and have fun while learning.

■   This was one of the best enrichments because I learned about dinosaurs. It was also interesting because I have been to the place where they dig up all of these dinosaurs.

■   This was so cool! It included hands on time, slides, and a basic information background. It remained interesting throughout.

■   He was a very good speaker who didn't drone on and he seemed comfortable with what he was presenting. This made his program much more enjoyable.

■   Craig Sundell, from KU, discussed the main two things paleontology has proven. (1) The Earth is very old... and (2) There is constant change in the physical properties of the Earth. He also discussed his finding in Wyoming, including the largest found example of a Camarasaurus. The site could soon be known as the most important paleontology site in the world.

■   Through his speech I learned that 99.9% of the organisms are extinct, that the continents on earth are constantly moving and have been moving for the past several million years.

■   This was a very interesting enrichment. It piques the interest of the child who used to read books about dinosaurs. The slides added a touch of realism, and made the subject more interesting since we realized just how close this is to us. This is a subject that's hard to tire of and Craig made it more so, just the way he handled it.

UPCOMING:

On **December 10th**, Frank Booth, a forensic chemist from the Kansas City Regional Crime Laboratories will return to speak on **SCIENCE IN THE CRIME LAB**.

Tuesday **January 4, 2000**, we'll hold our annual **PANEL DISCUSSION AND REUNION** with current and former MPI students from 7:00-8:45 a.m. in Room 207.

We have not yet confirmed speakers for January 14 or January 28, 2000.

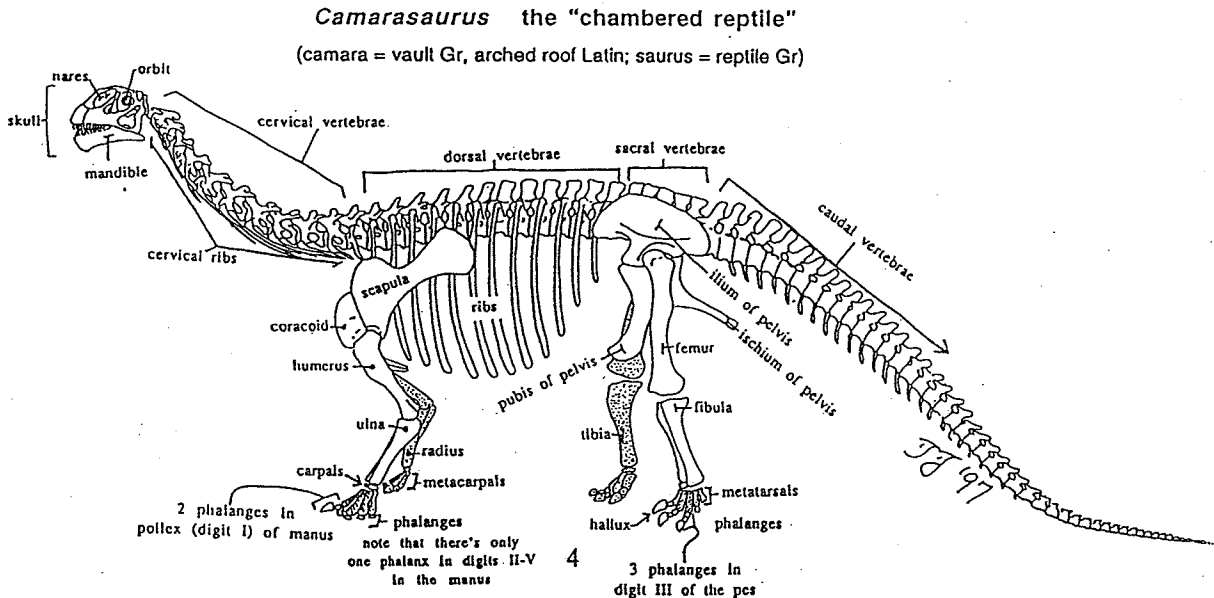## NEW (OR CHANGED) MPI ALUMNI E-MAIL ADDRESSES

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

CHANGES

(86-87) Patrick Liang
PATRICK.LIANG@prodigy.net or
Pliang91@alumni.indiana.edu

(97-98) Tabitha Kremer
Kremerta@washburn.edu

Camarasaurus the "chambered reptile"
(camara = vault Gr, arched roof Latin; saurus = reptile Gr)

4

WE HEAR FROM PAST STUDENTS

Melissa Akey (85-86)
(BA Mathematics)
(BA Secondary Education)

E-mail received 11/14/99:

"Being a teacher, I thought it was time for me to write my "How I Spent my Summer Vacation" paper. Unfortunately I kept starting my essay and then putting it aside before it was finished so now my essay is really long. Next time I will try to stay in contact sooner.

I finally figured out that this was my first summer where I would not be coaching a sport or taking college courses. I would also not be planning a wedding (two summers ago) or a major move (from MO to HI). I had free time. It was like a real vacation.

I visited the Big Island and got to see lots of the north side of the island. My favorite part was seeing the botanical garden and butterfly exhibit. At the butterfly exhibit you entered an enclosed area with flowers and flying butterflies. The butterflies were all around you so it felt like you were in a dream.

You know me; I could not rest the entire vacation. I tutored two adults and one teacher's son. All three cases were interesting. One adult was working on her real estate license and it was amazing how much of the material was in the Business Math textbook. One adult was working on passing the firefighter's entrance exam and it was amazing how much it looked like my Technical Math class. The firefighter's test looked like it was really very hard since you could not use calculators and some of the calculations were 3.14x4.5x4.5x4.5x32.4. It was fun to help the student who was getting ready for Algebra II since it gave me a reminder of the assumed knowledge for joining Algebra II.

Of course, no summer would be complete without proofreading the math questions in a SAT prep book. I bought a prep book which had 10 sample tests...way too much fun. Luckily I am not a math geek...I also read real books.

Tim and I took Mesher to the Oheo Pools on the other side of the island. The area has lots of pools which are fed by water falls. We were watching the kids jump off of cliffs into the pools which I decided I wanted to try also. When I joined the line there was an 18 year old boy in front of me who was too scared to jump. All of us were ready to push him in when he finally decided to back down from the ledge. I then immediately took two steps off the ledge. I went so quickly that Tim almost wasn't able to take my picture. I had so much fun that I had to jump a second time.

As the summer came to a close, the math department was starting to panic. Two of our math teachers left last year and only one spot had been filled. Luckily a few days before school started, we found a math major who was working on her education degree. She was not fully certified but at least she knew her mathematics. The other spot was filled by a business major. It has been great since both teachers have been willing to stay after school with the students so now I have company. I am really excited about the new school year.

First quarter went really well. Most of my students started out slow but are trying hard now that they know what I expect in my class. I am really pleased since there are only about 2-4 students in each class who are not on track. Hopefully those students will join in the fun..."

Angelina Walls (98-99)
(Physics Major)

E-mail received 10/5/99:

"Yo Delaware!! That formula is exactly what I was looking for. [Ed: The volume of a cone is just 1/3 of the volume of a cylinder of the same height and base radius.] Thank you very much!...Hey, I have a quote for you. Tell this to your MPI kids! They'll love it. "Alcohol and Calculus don't mix...don't drink and derive." That's great, isn't it? I love it. If I remember, I'll make you a sign that says it. We have now gotten into material that I don't know in Calc II. We are on series....what's the plural of series? Seriess? Serieses? Hum? Alrighty, well I'm sure there is something I could be studying right now.

Angelina the Great"

Daphne King (97-98)
(Civil Engineering Major)

E-mail received 10/8/99:

"I hope all is well with this year's MPI students. I was a Year 14 student from Van Horn, and am in my second year at UMKC in the civil engineering program. I currently work as a student

intern for the Environmental Protection Agency. If you need someone to speak on the student panel, I'd be glad to.

As a student at MPI I was given the opportunity to purchase a graphing calculator. I did not know how much they cost in the real world, so I thought I could get a better deal. I know now that I need one of those calculators. Is it possible for me to purchase one of those from MPI. I'm willing to pay what you request.

Thanks."

Jenny Green (97-98) .
(Chemistry Major)

E-mail received 11/5/99:

"The semester is almost over and I am getting ready for finals and to enroll for the next semester. I'm enjoying my nights of studying now that soccer is over. I get to bed at 1:00a.m. instead of 3:00 or 4:00a.m. I wish now that I had taken Calc 1 and 2 when I had the chance, but I am doing okay in Calc 2 now.

Since my parents are kind enough to keep the MPI newsletter, I was wondering when the alumni speaker day is in January? I would like to make it this year and to see all the strange people that I graduated with. [Ed: It's January 4, 2000, 7-8:45a.m.]

Thanks and I hope the year is going well for you."

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

E-mail received 10/12/99:

"Hi. How are things going at the MPI? MU is OK except I got a letter in the mail today saying they do not have an official transcript from UMKC and I cannot enroll for next semester without one. I am not staying for next semester; I'm going to go to UMKC after this semester, but I just want to make sure I did get credit for the classes last year even though I did not take the grades. Thank you.

By the way, be sure to give Melinda Hacker a hard time since she is a Truman student and you know what we are like after last year."

Gretchen Nguyen (97-98)
(Chemistry Major)

E-Mail received 10/23/99

"Hi...I just wanted to drop you a note and see how you are doing. I received the newsletter today. I can't believe it's been a year already. Time seems to run so fast nowadays. I'm sorry for not writing or keeping in touch. School has really kept me on my toes. This semester I am taking 22 credit hours. My hardest class is biochemistry. (We have a test Monday!) I extremely miss taking calculus and physics and am just in awe of anyone enrolled in the classes. With how my schedule is going, I unfortunately can't enroll in any of the classes for the remaining five years. Well, actually I do get to take one more physics course for my requirements, thankfully. At the moment, I am majoring in a BA in Chemistry. It is the best choice our school offers us. Most of my classmates are going for a BLA. For the most part, it's definitely much more feasible and less tiresome to chose BLA, when taking our med classes into account. I feel very fortunate though. The credits from MPI helped so very much. I loved everything we did. It was very awesome. From what I hear from some of my classmates, it seems the campus classes come nowhere near what I got to experience at MPI. Because of this, not everyone I have met has had an appealing interest in the classes. I wish that wasn't true, because the classes are really cool, mind provoking, and intriguing. Well, I just wanted to wish you all the best. Please tell Mr. Morse, Mr. Waring and Doris my wishes. [Ed: All three of these folks have now retired from the MPI.]"

NEW MPI E-MAIL ADDRESS:

mpi@umkc.edu

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

1999-2000 STUDENT FIRST IMPRESSIONS

"When I came to MPI, I felt I had been grossly unprepared for the calculus course. I was greeted with a warm, "You should know this, so I'm not going over it" speech. That shocked me. Then it angered me. Then I decided to do well on the test.

When I go to college, I won't be shocked when it happens again. Thanks, MPI!"

John Hershberger
Ft. Osage High School
Ft. Osage School District

"I like Suzanne. She likes my hair."

Sarah Steele
Van Horn High School
Kansas City, Missouri School District

"So far my journey through MPI has been challenging and mind-bending; every day I face new obstacles (You try to scale 50 steps at 6:50 in the morning!). But I know I will benefit greatly from my experience and be better prepared for college. Whatever doesn't kill me will only make me stronger."

Jessi Erickson
William Chrisman High School
Independence School District

"MPI is teaching me a whole new way of learning. In Calculus we cover the information that we need to, and if you want to learn it, do the problems. But if you think you know it, you don't need to. It gives you a responsibility to decide for yourself what you need to do."

Megan MacDonald
Truman High School
Independence School District

"I have two suggestions for MPI students of the future: First, students should automatically be enrolled in therapy. Second, there should be a yearly contest to see who develops a stress ulcer first and that person should get extra credit."

Sarah Smith
Paseo Academy
Kansas City, Missouri School District

"I like Sarah Steele. I like her hair!"

Suzanne MacDonald
Secretary
UMKC – Mathematics & Physics Institute

"Well, the second month hasn't been quite as bad as the first. Now I know that everyone else is just as lost as I am, or worse. I still feel really tired every morning, though. Maybe I should try going to bed before midnight...Anyway, that's all for now. I have to go jump back into the sea of derivatives and try not to drown."

Andrew Schmidt
Hope Christian School
(Independence School District)

A SOLUTION TO
MATHEMATICS CHALLENGE #60

Recall the problem statement:

Suppose $P(x)$ is a polynomial of degree 8 with Real coefficients, and we also know that $P(k) = 1/k$, for $k = 1,2,....,9$. [Meaning $P(1) = 1/1$, $P(2) = ½$, and so on, up to $P(9)$.]

What is the numerical value of $P(10)$?

[From: Which Way Did the Bicycle Go?, by Konhauser, et al., 1996, p. 33, #114.]

SOLUTION:

Notice that since $P(k) = 1/k$, for $k = 1,2,....,9$, then we have:

$$P(k) = 1/k$$
$$k \cdot P(k) = 1$$
$$k \cdot P(k) - 1 = 0.$$

So the nine integers $1,2,....,9$ are zeros of the polynomial $x \cdot P(x) - 1$.

Since $P(x)$ is of degree 8, this new polynomial is of degree 9, meaning those nine integers are in fact all its zeros. So, we can factor it as

$$x \cdot P(x) - 1$$
$$= c(x-1)(x-2)\cdots(x-9), \text{ for some constant } c.$$

Equating the constant terms on each side of this equation yields:

$-1 = c(-1)(-2)\cdots(-9)$

$\quad = c(-1)^9 \cdot 9!$

$\quad = -c \cdot 9!$, so

$c = 1/9!$

Now that we know the form of $x \cdot P(x) - 1$ completely, we can answer the question. For $x=10$ we have:

$10 \cdot P(10) - 1$

$= (1/9!)(10-1)(10-2)\ldots(10-9)$

$= (1/9!) \cdot 9!$

$= 1$, so

$10 \cdot P(10) = 2$

$\quad P(10) = 2/10 = 1/5$, as desired.

A SOLUTION TO PHYSICS CHALLENGE #51

Recall the problem statement:

At the same time that a high speed bullet is fired horizontally from a rifle, another bullet is simply dropped from the same height. Which bullet strikes the ground first?

a) The dropped bullet
b) The fired bullet
c) Both strike at the same time.

[From: Thinking Physics, Practical Lessons in Critical Thinking by Lewis Carroll Epstein, p. 130.]

SOLUTION:

The answer is: c. This is because both bullets fall the same vertical distance with the same downward acceleration. They therefore strike the ground at the same time (gravity does not take a holiday on moving objects.)

MATHEMATICS CHALLENGE #61

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:
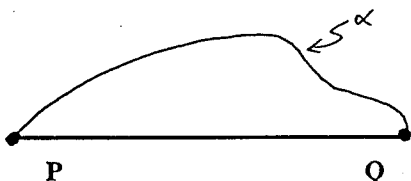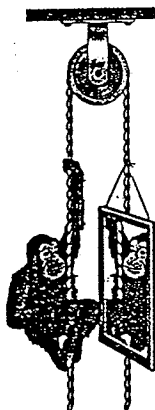

Prove that every such arc can be covered by an isosceles right triangle whose hypotenuse has length 1.
[Recall that such a triangle has 45, 45, and 90 degree angles.]

[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].

PHYSICS CHALLENGE #52

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.

ANSWER TO MATHEMATICS TECHNOLOGY REPORT PROBLEM #2

First, notice about the graph of $f(x) = (1+1/x)^x$, for x between -1 and 0, that the value of $f(-a/b)$, where $-a/b$ is a fraction (in lowest terms) in that interval with b an even integer, is always an imaginary number. For instance, try $x = -1/2$. Then $f(-1/2) = (1-2)^{-1/2} = 1/i = -i$. Since the calculator only reads and graphs Real numbers this explains why it fails to graph such y- values. Since such $f(-a/b)$ values are "dense" in any interval, the calculator "concludes" it can graph no points whatever between -1 and 0.

Secondly, the resolution (number of pixels) of the screen determines whether points like $(-1/3, f(-1/3))$ will graph. For instance this point can be made to appear if the window chosen is $[-1,1] \times [-2,2]$. Other points will appear in other well-chosen windows.

Thirdly, apparently the calculator stores some fractions with odd denominators, like $-3/7$, etc., only as decimal approximations, which then lead to imaginary numbers as above. Numbers like $-1/3$,

-1/5, -1/7, etc., seem to be stored as actual fractions and so result in correct, and graphable values.

Editor/Writer:　　　　　　　**Richard Delaware**