YEAR 11 - IN BRIEF

Currently enrolled in the MPI are 82 students, from East (1), Fort Osage (12), Northeast (21), Paseo (1), St. Mary's (3), Truman (17), Van Horn (6), and Wm. Chrisman (21) high schools.   Of these 37 (45%) are women, and 25 (30%) are minorities.

! MPI OPEN HOUSE !

Sunday Nov. 6, from 2-4 pm, the MPI will hold its annual OPEN HOUSE for parents, teachers, counselors, administrators, and anyone else interested in talking to the faculty, staff or students of the MPI.

We'll be in the Truman Campus Building of UMKC behind the Truman Library just north off Hwy 24 in Independence.   There will be 1) physics demonstrations and laboratory set-ups, 2) mathematics demonstration problems on chalkboards with SHARP graphics calculators on display, and 3) the MPI Calculus Lab in Room 223 will be open with MPI student assistants ready to demonstrate mathematics software to our visitors. In Room 207 at 2:30 pm, the MPI director will make some brief remarks and introduce the MPI teachers, and a 10-minute slide presentation will follow. And of course, there will be refreshments.   If you have any questions, please call 235-1272. You're invited!

! MPI OPEN HOUSE !
SUNDAY NOV. 6, 1994, 2-4 PM

SOME STATISTICS FROM OUR 93-94 ANNUAL REPORT

474 students have completed the MPI program (Years 1-10, Sept. 1984 - May 1994); 64% of these were male, and 36% female. (For the last two years more females than males have finished (55% and, 51%)).

On average, 75% of all MPI students who start the program actually finish.

157 college degrees, 106 in Science, Mathematics, or Engineering, to the best of our current knowledge, have been received by MPI Alumni from Years 1-5 (1984-89).

OUR NEWEST HIGH SCHOOL TEACHER

In the wake of the retirement of Joe Kaifes, our 10 year veteran MPI mathematics teacher, we interviewed last spring several men and women for his replacement, and unanimously agreed on hiring TINA KNUTSON, a mathematics teacher for the past 7 years at East High School. Along with Sheri Adams of Truman High School, this means we now have TWO women teachers here at the MPI.

Tina is the youngest of 14 (!) children, and grew up on a farm. (She vows NEVER to pluck another chicken, or to look at a dead cow

hanging from a tree!) After leaving these idyllic surroundings, she received her BS in Mathematics at Augsburg College in Minneapolis, MN, and her MA in Curriculum and Instruction at UMKC, and has since been nominated for the TANDY Mathematics/Science Teacher of the Year Award. Now, in addition to learning the "ways" of the MPI, and continuing to teach mathematics at East High School, she finds occasional time to read a good mystery, or play tennis.

We are pleased to have Tina join us at the start of our second decade, and hope she'll find the MPI a pleasant and even stimulating experience.

MPI E-MAIL ADDRESS:

rdelaware@vax1.umkc.edu

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

MPI ALUMNI E-MAIL ADDRESSES

Here are all the MPI alumni e-mail addresses currently known to us, listed alphabetically by year:

Year 1 (84-85)

Jody Breshears
75540.3172@compuserve.com
or breshear@umaxc.weeg.uiowa.edu
UNIV. OF IOWA

Doug Bullock
bullock@math.ucsb.edu
UNIV. OF CA-SANTA BARBARA

Pam Deters
70724.2143@compuserve.com
JAPAN

Brent Harding
harding@pat.mdc.com
MCDONNELL DOUGLAS-HOUSTON

Sheryl Nance
snance@emx.cc.utexas.edu
UNIV. OF TEXAS

YEAR 2 (85-86)

Phil Fleming
pfleming@nyx.cs.du.edu
INDEPENDENCE, MO

YEAR 3 (86-87)

Eugene Bae
baee@acq.osd.mil
THE PENTAGON

Suzanne Breshears
g_breshears@twu.edu
TEXAS WOMEN'S UNIV.

Ken Hill
khill@vax1.umkc.edu
UMKC

Pat Liang
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UNIV. OF INDIANA-MED. SCHOOL

John Winkler
jwink@uxh.cso.uiuc.edu
UNIV. OF ILLINOIS

YEAR 4 (87-88)

Nate Moore
Nate_Moore@notes.pw.com
PRICE WATERHOUSE ACCOUNTING

YEAR 5 (88-89)

Dean Keeling
dean_keeling@hp-corvallis.om.hp.com
HEWLETT-PACKARD CO.

Jon Morgan
jtmorgan@claudius.uncg.edu
UNIV. OF NORTH CAROLINA

Pat Windes
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NORTHWEST MO STATE UNIV.

YEAR 7 (90-91)

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WORCESTER POLYTECH

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UMKC

Matt Roberds
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UMKC

YEAR 8 (91-92)

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MIT

Chris Gross
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UM-COLUMBIA

Kristi Lynn
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UM-ROLLA

Mark Matson
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UM-COLUMBIA

Tony Prettejohn
c593863@mizzou1.missouri.edu
UM-COLUMBIA

Jeff Schreiner
cdt1599@falconnet.usafa.af.mil
US AIR FORCE ACADEMY

Sonya Smith
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MACALESTER COLLEGE

YEAR 9 (92-93)

Kristi Bass
stu93826@rckhrst1.bitnet
ROCKHURST

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DARTMOUTH

Eric Swearingen
s117312@umrvma.umr.edu
UM-ROLLA

YEAR 10 (93-94)

Sam Dorton
sdorton@sas.upenn.edu
UNIV. OF PENNSYLVANIA

Jeff Flowers
jsf006@acad.drake.edu
DRAKE UNIVERSITY

Jennifer Yutzy
jycow@iastate.edu
IOWA STATE UNIV.

ENRICHMENTS

FOLLOW UP

On Sept. 30, Mitch Dobson (MPI

89-90), currently the resident Prosthetist/Orthotist at Certified Orthotics and Prosthetics Associates in Lenexa, KS, spoke on **PRINCIPLES AND ADVANCEMENTS IN PROSTHETIC TECHNOLOGY**.

Some student comments were:

--I was fascinated to learn how real the artificial limbs can be made to look. In general, he presented the field of prosthetics in a way that we all could understand. Although I am still uninterested in prosthetics, I found the presentation very informative. It was obvious that Mitch gained much gratification from his work.

--I thoroughly enjoyed this presentation. Never before has the subject of prosthetics been discussed with me; I knew that artificial limbs existed, but about the closest contact I had had with them was the one-armed man in The Fugitive. I found it amazing that someone can be a cheerleader or run a race with an artificial leg. I am very thankful that I have all my limbs, but it is comforting to know that, should something drastic happen, I would not be totally restricted for the rest of my life, but could continue almost normally.

--I didn't realize or really think about how physics helps or that so much planning is needed.

--The speaker talked about how he used different aspects of physics to ensure the quality and comfort of the artificial limb. He talked about how they use tools to hide the limb, or to disguise it. He also talked about different limbs made based upon the patient's activity level.

--He described many different situations relating to amputation and the procedures followed to fit the amputee with a functional, comfortable artificial limb. He also brought with him examples of different types of artificial limbs to show how much technology has advanced and improved over the years. He did a really good job of relating what we will learn here, to the actual application to an important field.

--He made a vivid connection to physics involving pressure and vector placement. He takes you on a walk

down the steps of getting a prosthetic limb. Beginning with measurement following all routes-including a section on CAD/CAM (laser) uses in prosthetics. All the way to the cosmetic aspect or the genuineness of a prosthetic limb.

--You use vector quantities when working with the joints and the insides of the legs.

--This topic, which I thought would be boring, turned out to be very interesting to me. It turns out that prosthetic limbs are very technologically advanced. By some of the things that he showed us I think that very soon we will have fully moveable artificial limbs. I think that it was very interesting how the runner with two artificial legs was only 1 second behind a world record in the 100 m. Overall it was a very good presentation.

--The speaker conveyed his message very well. He suggested to us that we study hard at the MPI, because it's an opportunity that will do us good in our future, as it is doing for him.

--This was fascinating!! I am interested in the medical field and this was extremely interesting. I had no idea of the level of advancement in technology that has occurred in the last few years. I was impressed with the precision of the movement made possible by the prosthetics, and with how real they look now. I especially enjoyed the visual aids he brought. He was obviously very, very knowledgeable about the subject, which made for a much more interesting presentation.

--He has to make the support of the leg in the right area or it will cause the patient a lot of pain. He showed us all of the different angles he has to look at at the elbow and knee joints so they will move properly. I was surprised how realistic some of the artificial limbs looked.

--He makes a cast of the "stump" and looks at what bones, nerves, and muscles are still there. For a synthetic leg, the stress of standing and walking must be put on parts of the remaining limb where the bones could take the pressure. For arms, the doctors are able to harness small electric charges through the arm

(myoelectric charges) to trigger the fake hand so it will open and close by itself.

UPCOMING

On Oct. 14, Kathleen Fuller, a physical anthropologist from the University of Kansas, will speak on **BIG BRAINS AND BIPEDALITY.**

Oct. 28 will bring Steve Chiappari, a mathematician from Avila College to talk about **THE GAME OF LIFE,** an interesting mathematical game.

Finally, on Nov. 11, we'll make our annual all-day field trip to the **NUCLEAR RESEARCH REACTOR** at the University of Missouri-Columbia campus.

WE HEAR FROM PAST STUDENTS

JEFF FLOWERS (93-94)
(International Business Major)

9-2-94 e-mail:

"Could you please add (my e-mail) address to the MPI directory? I also need to know who to contact for a transcript of my classes at MPI. I probably won't have to take Physics. I wouldn't have to take Calculus, either, but I want to reinforce it. The course is also called Business Calculus, so I want to learn the business applications. My only problem with this class is I have a rookie in college calculus as a professor. That class is extremely boring.

Well, I thought that you might want to know what MPI prepared me for. Basically, I'm not real sure yet. I do know that I had to learn how to be responsible for my own homework. I also know that I am now able to listen to and absorb lectures while only half-awake.

Well, that's it for now. Tell Tim Gamboa and Mr. Morse that I said "Hi". Till later, Jeff."

JON MORGAN (88-89)
(BA, Music)

9-5-94 e-mail:

"I am currently in NC pursuing a four year course in line for my

Doctorate in Vocal Performance Pedagogy. I would like to drop you the addresses of some other MPI graduates...

It sounds to me like things at MPI are going very well. I recently talked to Mrs. Adams, my calculus teacher at MPI, and she had some wonderful things to say.

Would you be able to confirm the rumor that Mr. Morse has retired. If he has it is a great loss to the teaching profession. He was perhaps the best teacher I had in any course; math, music, or otherwise.

Thank you for taking the time to read my letter."

SAM DORTON (93-94)
(Chemistry, Mathematics Major)

9-13-94 e-mail:

"Greetings from Philadelphia! Everything is going smooth so far. I am enrolled in Math 141 (Calc II), Math 200 (Introduction to Mathematical Analysis), Organic Chemistry, General Chem Lab, and African-American Literature. MPI has me well prepared for 141, but in the first two lectures, the prof. has covered what we spent two to three weeks on at MPI (arc length, separable differential equations, and surface area). We will be using a computer program called Maple V, probably because it is the cheapest one that runs on both Macintosh and Windows.

I hope that all is well at the MPI. From the August Newsletter, it appeared that you would be having a very large class, not only over-all, but also in the Calc. I & II section. I was glad to see this, especially the fact that there were many students from St. Mary's enrolled. Keep me updated as to exciting events."

DEAN KEELING (88-89)
(BS, Mechanical Engineering)

9-16-94 e-mail:

"Howdy, It's nice to hear from you. Yes, I've been working here at HP for a year now. I graduated from MU in 4 years with a BS in Mechanical Engineering and started here two weeks after graduation. I am actually not in the calculator division. It was a mainstay here from the beginning through the 48GX, but now the calculator work is done elsewhere and that division works on subnotebook computers and personal digital assistants. The main portion of HP-Corvallis is now actually inkjet components and that is what I am involved with. Our inkjet printers are mostly made in Vancouver, WA, but we make the print cartridges here. I am a product engineer dealing with quality issues on our high capacity black ink cartridge. I am often designing experiments and conducting tests and working on possible product improvements.

I really like it here at HP and here in Oregon. It doesn't ever get hot or humid here in the summer and it doesn't get very cold in the winter. It also doesn't rain as much as some people would lead you to believe. There are a lot of things to do here with mountains, ocean, rivers and decent sized cities so close.

It was good to hear from you."

PAT LIANG (86-87)
(BS, Biochemistry,
 Univ. of Indiana Medical School)

9-23-94 e-mail:

"Just dropping a quick note of greetings from Indianapolis. I have time this afternoon to do some research, so I thought I would email before 3:00 rounds.

Everything is going great here. I am so ready to graduate it is unreal. Residency looks like it might be back in the KC area, either at KUMC or Truman Med. Specialty looks like Medicine-Pediatrics.

Sounds like y'all have your hands full this year...88 students is an awful lot of warm bodies. I hope all is going well so far and that they are paying attention in class... especially if they are experiencing one of your lectures!!!

Tell everyone I said "Hello." Especially send greetings to Mrs.

Adams, Mr. Morse, Mr. Waring, and ... oh what the hey, give it to everyone!!

It is finally getting cooler out here. It started raining this morning and is showing no sign of letting up. It is also rather nippy out, even in shirt and tie and white coat!! Winter is creeping upon us very slowly!!

I shall sign off now... Stay in touch and Good Luck with the new year!"

1994-95 STUDENT IMPRESSIONS

"The first time I heard of the MPI was in my eighth grade Algebra I class when Raymond Rast and Theresa Darby (two MPI students from Wm. Chrisman) came and talked to us about the program. At that point I thought, "Hey, that's what I want to do my senior year." Here I am, and so far it's living up to 4 years of expectations. I like the independence I have as a student; I think it promotes a responsibility concerning my education that a high school setting can often-times stifle. I'm looking forward to an enjoyable year of learning."

Pamela Moseley
Wm. Chrisman High School
Independence School District

"Attending the MPI is all about organization. I advise you to schedule your tests and the days you study each of your subjects in a planner or on a calendar."

Greg Long
Van Horn High School
Kansas City School District

"We came here from our separate schools not knowing what to expect. We found friends from the past, and made friends for the future. We discovered learning, enthusiasm, and smiling faces around every corner. Although we are only two-and-a-half weeks into this year at MPI, already we are beginning to realize the challenges, responsibilities and fun available at the MPI."

Anne Croston
Ft. Osage High School
Ft. Osage School District

A SOLUTION TO MATHEMATICS CHALLENGE #34

Recall the problem statement:


Show that any convex polygon of area 1 can be enclosed in a parallelogram of area 2.

[DEF: A polygon is <u>convex</u> if the line segment between any two points on or in the polygon is entirely contained <u>inside</u> the polygon.]

[From: Challenging Mathematical Problems with Elementary Solutions, Vol.II, by Yaglom & Yaglom.]


SOLUTION:

Suppose we have a convex polygon of area 1, and we call it M. Let AB be one of its sides, and let C be a point on our convex polygon M which is at a MAXIMUM distance from the line containing AB. So, C could be at a corner, or on a side:
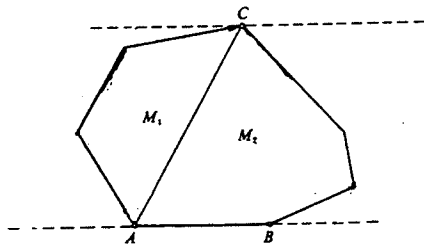
Next, as seen above, draw the line AC which divides the convex polygon M into two parts, say, M_1 and M_2. [Of course, one of these two parts may not exist if AC turns out to be a side of M!] Then, find two points on M, say, D_1 and D_2, which are at MAXIMUM distances from the line AC, and lie on either side of AC.

We are now ready to draw our parallelogram, which we'll call P. One side is the line through AB; its opposite side is a line parallel to AB, drawn through C; and the last two sides are lines, both parallel to AC, drawn through the points D_1 and D_2. This forms a parallelogram P as shown below:
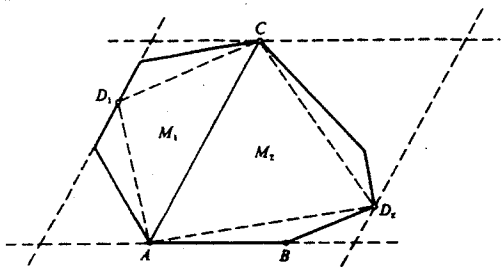
Now, since M_1 is also a <u>convex</u> polygon, it contains the entire triangle $\triangle AD_1C$, and similarly M_2 contains the entire triangle $\triangle AD_2C$. Lastly, the line AC divides the parallelogram P into two smaller parallelograms, say, P_1 and P_2. So we have:

Area$(\triangle AD_1C)$ = $(1/2) \cdot$ Area(P_1) , and
Area$(\triangle AD_2C)$ = $(1/2) \cdot$ Area(P_2) .

It then follows that:

$$\begin{aligned} \text{Area}(P) &= \text{Area}(P_1) + \text{Area}(P_2) \\ &= 2 \cdot \text{Area}(\triangle AD_1C) + 2 \cdot \text{Area}(\triangle AD_2C) \\ &\leq 2 \cdot \text{Area}(M_1) + 2 \cdot \text{Area}(M_2) \\ &= 2 \cdot \text{Area}(M) \\ &= 2 \text{ , since Area}(M) = 1. \end{aligned}$$

If the area of parallelogram P happens to be strictly less than 2, we can expand it to equal 2 by translating any one of its sides outward by a suitable distance. The larger parallelogram will of course still contain our original convex polygon M.

A SOLUTION TO
PHYSICS CHALLENGE #25

Recall the problem statement:

Given a candle that is the diameter of a small birthday candle, but five miles high, how long (in days) would it burn, to the nearest power of 10?

[From: Physics Olympic Handbook]

SOLUTION:

The answer should be the time in days a single small birthday candle will burn multiplied by the number of birthday candles there would be in one 5 miles high.

A typical birthday candle might burn about 15 minutes. This is about 1/100 (10^{-2}) of a day/candle.

It would take about 4 of these

candles to make a candle one foot tall. So, it would take (5280 ft/mile) $\cdot$ (5 miles) $\cdot$ (4 candles/ft) $\sim$ 100,000 = 10^5 candles to make one 5 miles high.

Therefore the number of days a candle 5 miles high will burn is:

$(10^{-2}$ days/candle$)(10^5$ candles$)$ = 10^3 days.

MATHEMATICS CHALLENGE #35

What is the curve of minimum length which bisects the area of an equilateral triangle?

[From: Mathematical Quickies, by Charles Trigg]

PHYSICS CHALLENGE #26

WHO'S WHO IN PHYSICS?

Two cylinders, one of lead and the other of aluminum, are identical in physical dimensions and both are painted so as to be similar in appearance. They both weigh the same, the aluminum being solid while the lead is hollow. Using no other objects, how could you determine which is which? (Note: The lead cylinder does not sound hollow when tapped. You may not scratch or damage the cylinders.)

[From: Pasco Scientific]

Editor/Writer: **Richard Delaware**