



FIRST SEMESTER -- TOP TEN

By taking the mean of their college Calculus and Physics grades for the first semester, we have determined our current top ten MPI students. We congratulate them all. Alphabetically by schools, they are:

Chris Gross	(Fort Osage)
Scott Hummel	(Fort Osage)
Chheng Meng	(Northeast)
Brian Huss	(Truman)
John McCarty	(Truman)
Jeff Schreiner	(Truman)
Sonya Smith	(Truman)
Yan Pei Chao	(Wm Chrisman)
Laura Dilley	(Wm Chrisman)
Leslie Farrow	(Wm Chrisman)

**RECRUITMENT DAY -- FEB. 11
SIX HIGH SCHOOLS COME TO VISIT**

On Tuesday Feb. 11, we are inviting interested juniors and their teachers from the six high schools involved in the MPI program for a visit and presentation. We usually host about 130 students for this gathering each year. They will arrive between 8 and 8:15 am and, with MPI student tour guides, take a short tour of the MPI classrooms. There will be MPI students at work in the calculus PC lab, in the physics lab, and two groups in physics problem-solving sessions. Following the tour, everyone will be led to Rm 207, "The Loft", to receive an MPI brochure, this issue of the newsletter, a donut (!), and be seated for our slide show and physics demonstration presentation. Afterward, several MPI students will be asked to share their thoughts about the program, and we'll all take questions from the audience.

NEW MPI BROCHURES

A fresh, newly-designed MPI brochure is now available, replacing our original one from 1985. The new cover sports a complex fractal image (a self-squared Peano dragon), while the inside features photographs, student quotations, physics and mathematics formulas, and of course, a description of the MPI program.

If you would like a copy call our MPI secretary at 235-1272.

TEAMS TEST TEAM -- 1992

This year we enter our 4th TEAMS (Tests of Engineering Aptitude, Mathematics and Science) team. The test is in its 13th year and is sponsored by JETS (Junior Engineering Technical Society). For the second year the test will consist of a single two-hour test covering the six subject areas of Biology, Chemistry, Computer Fundamentals, English, Mathematics, and Physics to be taken by the entire team of 8 students working as a group. All books, notes, and calculators are allowed, and team members are encouraged to talk together. The test will be held at the UMKC Truman Campus on Feb. 14, and will require the entire school day.

Our team this year is:

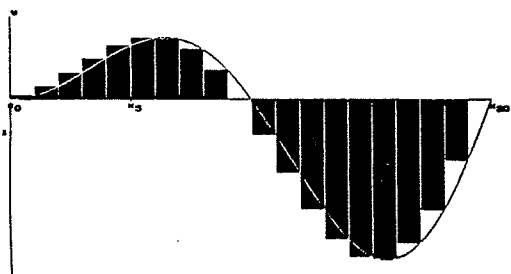
Gary Cauthon	Scott Hummel
Laura Dilley	Mark Matson
Chris Gross	Jeff Schreiner
Pat Hayden	Sonya Smith

Best of Luck!

CALCULUS LABS REPORT

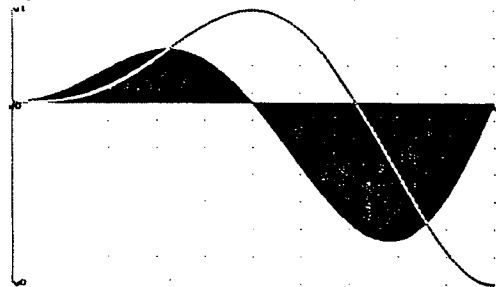
As of this writing, those MPI students taking Calculus I have had 10 calculus computer labs since September, during which we have learned to adapt materials from the two lab manuals we are using, and begun to compose our own experiments. Since a CALCULUS laboratory should primarily focus on CALCULUS and not be mired in technical confusion, we are thankful to be largely past major technical difficulties. Our students seem comfortable with the software, and (we hope) can now concentrate on conceptual mastery.

For instance, in a recent laboratory session using the program MICROCALC (which complements our primary program, DERIVE), the laboratory was written by the mathematics coordinator and designed to be a lesson in visualization. It fell into two parts, each of which was then applied to 5 different functions. For example, one function was $f(x) = x\sin(x)$, for x in $[0, 2\pi]$. The first part of the lesson was to examine approximations to the area between the graph of f and the x -axis by rectangles whose height, say, is determined by the value of f at the RIGHT-endpoints of regular subintervals of $[0, 2\pi]$ on the x -axis. MICROCALC instantly produced the following picture:



Students then examined left-endpoint and midpoint approximations. (The number of rectangles, here fixed at 20, can be increased to develop a sharp sense of HOW the area is approximated.) The second part of the lesson was to see the graph of the definite integral being drawn at

the same time as the graph of the function. What the notions of AREA and DEFINITE INTEGRAL are, and how they differ was instantly clear:



These are some of the deep ideas of the calculus we wish to convey, and for such the PC is a superb tool when used with mathematical purpose and with care. As it was, our students had ample time to carefully watch the graphs, point to the screen, and discuss what they were seeing with their partners. Perhaps some of it will stick.

We have just learned that the Independence School District will be purchasing copies of DERIVE for both of its high schools. Van Horn High School in the Kansas City MO District has also ordered 12 copies of DERIVE. Our other two participating high schools, Northeast and Fort Osage, are reportedly considering similar purchases. We applaud these far-reaching decisions. Not only will the schools themselves quickly find uses for the program in their higher classes, but if every high school involved with the MPI were to have DERIVE onsite, we would finally be able to assign homework of a more thoughtful and realistic nature.

Finally, we have asked our students for written comments and advice about DERIVE and the PC labs in general. Their excellent responses have been noted and will soon be acted upon.

CONVENTIONS -- THERE AND HERE

From Jan. 4-9 our two high school physics teachers, Calvin

Nelson and Larry Harding, attended the National Association of Physics Teachers (NAPT) national convention in Orlando, Florida. They returned with reports of demonstrations on the physics of toys, as well as how to build various apparatus such as a microgravity bucket, an inertial chain, and how to videotape the Coriolis effect. Of course, between talks they visited the Kennedy Space Center, and Disney's Epcot Center. Later, back at the convention, they learned of a Chicago school which actually takes an annual physics trip to Epcot, doing physics experiments every step of the way, from the plane ride, to the Orlando Tram, to the many exhibits of Epcot itself. A typical experiment question was:

"Using your accelerometer, measure the banking angle and subsequent centripetal acceleration for a typical pass around an airport."

On Sat. Jan. 11, the KCATM (Kansas City Area Teachers of Mathematics) organization held its Winter conference at Central High School, and two of our mathematics teachers, Sheri Adams and Al Morse, attended, enjoying in particular the talks on using graphing calculators, and on problem solving.

ENRICHMENTS

FOLLOW UP

There were a few changes this year in our 7th Annual Panel Discussion on Jan. 3. Instead of in the gym, it was held in Rm. 207, where the old Truman campus library used to be, a very nice room now known as 'The Loft'. Instead of just one moderator, there were two, Sheri Adams and Al Morse, who together stimulated the discussion and encouraged panelist remarks. Each of the 7 panelists first spoke at length about his or her college major,

college experience, and for some, their professions after college, sharing advice with this year's MPI class. Then some specific questions were posed by the moderators, and questions from the audience were taken.

The alumni panelists this year were:

Robin Crick (néé Steen)	84-85
BS Accounting (UMC)	
Accountant	
Phil Fleming	85-86
BS Sec. Education, Chemistry (UMC)	
Secondary School Teacher	
Sarah Littlewood	85-86
BA Mathematics/Physics (Wm. Jewell)	
Mathematics Graduate Student	
Kim Brox (néé Gallagher)	86-87
BS History (Iowa State)	
Jason Anderson	90-91
Worcester Polytechnic	
Jennifer Spungen	90-91
St. Louis University	
Kendra VanTuyl	90-91
Washington University	

Their presentations were fresh, informative, funny, and well-done.

After the panel, orange juice and donuts were available, two slide projectors were set up with carousel trays of slides from each of the previous 7 years of the MPI for students to view, and we otherwise broke into small groups to visit. In all, 25 former MPI students appeared.

When UMKC physicist Dave Wieliczka spoke on Jan. 17, he had with him a 15 milliwatt helium-neon laser which produced an intense red light. He first explained what a laser is, how light waves are organized and amplified to march in-step. Then, he told us how almost

any material can be made to 'lase' whether gas, liquid, or solid, and all waves of the electromagnetic spectrum can be produced, even infra-red, ultraviolet, and X-rays. For instance, the Bendix Co. uses carbon-dioxide lasers to weld, while elsewhere infra-red lasers are now being used in pairs as 'optical tweezers' to move individual strands of DNA!

Dr. Wieliczka also gave all of us an 'eye exam' by having us turn our heads from side to side while observing the direction of movement of the speckles we saw in an expanded spot of laser light focused on a screen.

UPCOMING

On Feb. 14, Frank Booth, a chemist at the Kansas City Regional Crime Center, will be making a belated appearance, following his cancellation Dec. 13. The title of his talk is once again: SCIENCE IN THE CRIME LAB, and we are very pleased he will be able to speak. His past talks have always provided fascinating insight into scientific detection.

Feb. 28 will bring Larry Deaton, Assistant Superintendent for Secondary Education of the Fort Osage School District, and well-known lecturer. His subject will be: RIGHT BRAIN/LEFT BRAIN THEORY. He is an engaging and lively speaker, and his talk last year on Birth Order was exceptionally well-received.

Finally, on Mar. 13, we will be taking our second field trip of the year, this time to view the NATURE'S FURY exhibit at the Kansas City Museum. The museum has made special arrangements for us, and we are grateful. Over the last few years they have made a serious effort to bring science and technology exhibits to our area, and we applaud their work. This particular exhibit,

originally from the Oregon Museum of Science and Industry, has 13 components and is interactive. It "gives visitors the opportunity to feel an earthquake, touch a tornado, ride a fault, move continents ... to play with wind, water, fire, and earth..."

PAST STUDENTS WRITE TO US

BRENT HARDING (84-85)
(BS Aerospace Eng.; McDonnell Douglas Space Systems Company)

"Thank you very much for your invitation to participate in the MPI's 7th Annual Panel Discussion. I enjoyed my past appearance on the panel and I hope the students found it informative. Unfortunately, I will not be able to participate this year.

It's hard to believe that the MPI is in its 8th year already. It does not seem that long ago that I was a student at the Institute, busy getting my first exposure to college-level Physics and Calculus. The Institute served as an invaluable springboard for my college career, and I know it has helped many others as well.

...Congratulations to you both on making the MPI such a successful and useful tool."

HOA BUI (86-87)
(Pre-Med Major)

"This summer I was selected along with eight other students to participate in a research program. We went to the Dominican Republic for three weeks to collect our data and spent the rest of the summer in the United States organizing the data. As a result of this, I have submitted two manuscript(s) to parasite journals. One is in review and the other has been received, hopefully

they will be published by the end of next year.

From the above, you might have guessed that my research (was) on parasites (specifically lizard parasites). I had such a wonderful time learning about the people in the Dominican Republic (learning about their history and then actually visiting some of the sites). As a result of this I want to combine research and medicine (practicing) into my future career."

ERIC MARSHALL (86-87)
(BS Management;
U.S. Air Force Student Pilot)

"I wish I could make it to the reunion, but I have to work. I now live in Del Rio, Texas with my wife Elizabeth. I work on Laughlin Air Force Base. Currently I am training in the Cessna T-37 which is a twin engine jet aircraft. Next spring I will be moving into the Northrop T-38 which is a supersonic trainer.

My time with MPI helped me to be more prepared for academics at the Air Force Academy. Without MPI, I feel I probably would not been able to enter the Academy. The math courses at the Academy were very difficult and every bit of preparation helped. I graduated on 29 May 91.

Please relay my regards to Mr. Nelson."

KENT LAUER (86-87)
(Mechanical Engineering Major;
Billy Goat Industries Inc.)

"This is a fabulous program and I'll be happy to tell anyone who'll listen to me about it. I'm just sorry that our school district (Raytown) dropped the program. If I can help you, let me know."

RON OVERBECK (89-90)
(Major Undecided)

"I've noticed that the instruction I got at MPI was designed to insure that the most possible students understood what we were doing. At college they presented the information and said: here it is.

I would recommend to any student involved in MPI, to enroll in both calculus classes, it may seem harder at the time, but they'll have more of an opportunity to get help from the teachers because of their teaching style. It would be easier to do it at MPI than at college."

TAMMY PHELPS (88-89)
(Pre-Med Major)

"I have only had a physics course since (the MPI) and I kept comparing it to the structure of MPI's course and thinking "what does this teacher think he's doing?". MPI was much better quality and easier to learn from.

The credit hours put me ahead of a lot of students, which helped, especially since I have many extra courses to take for pre-med. MPI provided a bridge between high school and college and gave me an opportunity to form study habits which have carried into my college years.

It is a fine opportunity for high school students. I only wish more students could benefit from such a program.

Sorry I missed the reunion. I would've been there but I had a slight problem with my alarm clock when it went off at 5:45 am. Everything is going well at school. Only one more semester of Chemistry! I'll drop in some time and see ya if the MCAT preparation doesn't take too much time. Keep up the good work."

TONIA CARTER (87-88)
(Computer Analyst Major)

"MPI was the place that I learned to study. Without it I probably wouldn't have made it this far.

It helped me develop my study skills. I never had to study before MPI. The instructors really made me think.

Be tougher on the students. It's better to over-prepare them for the 'ways of college' than to leave them thinking 'its a lot tougher than they said it would be'."

KIM BROX (neé Gallagher) (86-87)
(BS History;
Math/Natural Science Minor)

"Am starting to substitute teach and am also looking for a teaching contract. Regardless of what happens, I will retain my sanity and standard of living. KU has a masters program which I am thinking about, but I'm not ready to go back yet at any price--even staff rates.

Depending upon the hunt, I might consider an administrative position in the private sector."

CANDI SMITH (88-89)
(Pharmacy Major)

"MPI courses taught me how to study for college courses.

My participation has most likely made me more competitive and more inquisitive."

SHERI HARRISON (90-91)
(Major Undecided)

"The pre-college experience,

gave me a preview of college; plus all the people and friends I made from different schools."

DARRELL KEMPKER (86-87)
(BS Computer Science;
Minor-Mathematical Science)

Currently I am employed at the Kendra Co., which is a small company here in town. I began work there at age 15 as a part-time employee after school and during the summers full time. I continued working there during college, learning more about the company and writing and maintaining a large program. After graduating college, I started a search for employment elsewhere but after discovering the poor economy situation decided to stay. I look forward now to a future partnership within 10 years. Therefore, I plan to attend some night classes in Electrical Engineering at an area college.

I would recommend any high school seniors that have intelligence enough to stand out in today's lagging high schools to 'look out for number 1' and force a better education for yourself. It is too easy to sit back and ride through high school and end up flippin' burgers to support your pregnant teenage wife. I say when there is an opportunity presented like MPI you have to realize now how it will help later. MPI definitely makes the transition to college less traumatic."

MORE 1991-92 STUDENT IMPRESSIONS

"When asked to come up with a quote for the MPI Newsletter three things came to mind:-

1. Pain builds character.
2. You learn from your mistakes.
3. A quote from Ecclesiastes--'For in much wisdom is much grief, and

increase of knowledge is increase
of sorrow'."

Mike Johnson
Wm. Chrisman High School
Independence School District

"Even though MPI is difficult,
it is also fun and a learning
experience. I found out that these
courses are very challenging, but I
would not want to give up easily
because it's preparing me for next
year. I am glad that I have the
opportunity to become a part of MPI."

Chheng Meng
Northeast High School
Kansas City MO School District

"MPI what an ... enlightening
way to start your day. I can
honestly say I've learned more here
at 7 in the morning than anywhere
else. But of all the facts and
figures we absorbed, the most
important thing must be that exercise
is the best way to start your day.
Why else would they make us park 4
flights of stairs below our
classrooms?"

Sonya Smith
Truman High School
Independence School District

"I think MPI is a good
experience of what college might be
like. It's not too bad as long as
you keep up and stay awake."

Scott Hummel
Fort Osage High School
Fort Osage School District

A SOLUTION TO
MATHEMATICS CHALLENGE #21

Recall the problem statement:

A student thinks of five
numbers. She adds them in pairs to
get the sums 14, 18, 22, 24, 25, 29,
31, 33, 35, and 39. Find the five
numbers.

[From the AMP-LINE Newsletter, Spring
1990.]

SOLUTION:

Since the ten given sums are
distinct, so are the five numbers.
Denote them by x, y, z, u, v where $x < y$
 $< z < u < v$. The smallest sums in
pairs must be $x+y$ and $x+z$, while the
largest sums in pairs must be $z+v$ and
 $u+v$. This gives four BASIC
equations:

$$x + y = 14, \quad x + z = 18,$$
$$\text{and, } z + v = 35, \quad u + v = 39.$$

If we then add the ten given sums, we
get:

$$14 + 18 + \dots + 39 = 270.$$

But this is the same as adding

$$(x+y) + (x+z) + \dots + (u+v) = 270$$

$$4x + 4y + 4z + 4u + 4v = 270$$

$$x + y + z + u + v = 67.5$$

Subtracting from this equation the
first and last of the four BASIC
equations, we have $z = 14.5$. Using
this fact, together with the four
BASIC equations once again, we find
the five numbers to be:

$$3.5, 10.5, 14.5, 18.5, \text{ and } 20.5.$$

A SOLUTION TO
PHYSICS CHALLENGE #12

Recall the problem statement:

How many revolutions would a 14
inch (diameter) tire make during a

trip across the continental U.S.?

[The object here is to estimate the amount to the nearest power of 10 (order of magnitude.)]

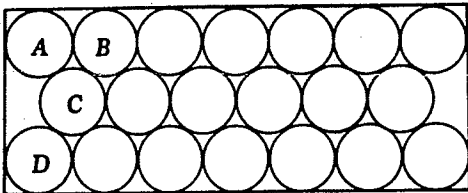
SOLUTION:

In one revolution a 14 inch tire would travel only about 4 ft. To the nearest power of ten this would be about 10^0 ft/rev. It is certainly more than 100 mi (10^2) across the U.S, but much less than 10,000 mi (10^4). Therefore, the nearest power of ten would be 10^3 mi. There is more than 100 ft/mi (10^2) and less than 10,000 ft/mi (10^4). Therefore the nearest power of ten would be 10^0 ft/mi. Thus the number of revolutions R would be:

$$R = \frac{(10^3 \text{ ft/mi})(10^3 \text{ mi})}{10^0 \text{ ft/rev}} = 10^6 \text{ rev}$$

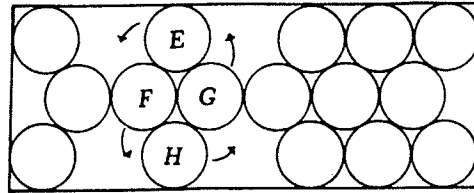
MATHEMATICS CHALLENGE #22

A man was looking at a full package of cigarettes from which he had torn the end,



and wondered how many could be removed WITHOUT LOOSENING any others. So, he tried rearranging them.

Obviously if C was missing, A could slide down, and D up. Or, if A was missing, C could slide out from between B and D. But, the removal of B left things firm. He soon also found out that the arrangement below was no good



because the group EFGH could rotate as a whole.

He was never able to pack in less than 15 firmly, but he did find an arrangement with 5 cigarettes in each of the three rows. What was this arrangement?

[From: Mathematical Brain Benders, 2nd Miscellany of Puzzles, by Stephen Barr]

PHYSICS CHALLENGE #13

Should you hit a hardball and a softball differently? In particular, should there be more follow-through for one than for the other?

[From: The Flying Circus of Physics by Jearl Walker]

Editor/Writer: Richard Delaware

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