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October 1, 1989

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**BBQ AND HAYRIDE  
SATURDAY, OCT. 14, 1989**

In order to encourage a comradery among our students that often doesn't gel until later in the year, on Saturday Oct. 14, 1989 from 5 to 9:30 pm, Richard Waring will host our second MPI barbeque and hayride at his home in Liberty. Participation is voluntary, so students will be responsible for their own transportation. But food, hay, and a pleasant environment for games will be provided by the MPI staff.

**MPI OPEN HOUSE !**

**SUNDAY, NOV. 5, 1989, 2-4 PM**

Sunday Nov. 5, 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 Institute.

We'll be in the Truman Campus Building of UMKC behind the Truman Library just North off Hwy 24 in Independence. We plan to have several rooms organized with physics demonstrations and laboratory equipment, mathematics demonstration problems on chalkboards, and videotapes of recent problem-solving sessions and past enrichment speakers. We may even be fortunate enough this year to have our new MPI computer system on display. In Room 102 at 2:30 pm, there will be some brief remarks by the MPI director and the introduction of the MPI teachers, followed by a 10-minute

slide-tape presentation, and of course, refreshments (!), all staffed by this year's students and faculty. If you have questions, please call 276-1272. We invite you all and look forward to seeing you on:

**SUNDAY, NOV. 5, 1989  
2-4 PM**

**WE WELCOME A NEW SUPERINTENDENT**

As of July 1, Dr. Ben Whited became superintendent of the Fort Osage School District, replacing Dr. Victor Gragg. Dr. Gragg was one of the superintendents originally involved with the creation of the MPI and we are sorry to see him go; he was a great supporter of our program. We do, however, look forward to an equally productive relationship with Dr. Whited, and welcome him to his new position, and of course extend him an invitation to visit us at any time.

**A BRIGHT NEW CLASS**

As of this date we have 63 students enrolled in the MPI, 61 in Calculus and 56 in Physics, from Fort Osage (15), Northeast (14), Truman (14), Van Horn (7), Wm Chrisman (12), and Ruskin (1) High Schools. Of these, 19 (30%) are women and 20 (32%) are minorities. We are nothing if not eclectic!

**ENRICHMENTS**

Our study skills special enrichments for Note-taking and

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Textbook Reading on Sept. 13, and Time Management and Test-taking on Sept. 20 were once again well-received by our students:

- This speaker made me realize that I tend to waste time and to procrastinate.
- This was really useful because I wasn't quite sure how to handle and approach test-taking at the Institute.
- I will be helped by all those techniques, but especially the book writing.
- Did a great job getting this point out, and had good techniques.

On Sept. 27 our regular bi-weekly enrichments began with a perennial favorite (this was his 6th visit to the MPI!), Dr. Henry Mitchell, who came to talk to us about his passion for BATS. With him was a live 'big brown bat' which he carried about the room for our students to touch and see this fascinating mammal at close range.

#### UPCOMING ENRICHMENTS:

On Oct. 11 we welcome for the first time Dr. Daniel Stern of UMKC's Biology Dept. to speak on: SCIENCE: WHAT IS IT? HOW DOES ONE DO SCIENCE? His lecture should help clarify for our students the history and philosophy of science, as well as the actual day-to-day practices of working scientists and scientific reasoning, via case studies from the life sciences.

Oct. 25 brings another newcomer, Frank Booth, a forensic chemist from the Kansas City Regional Crime Lab. He will speak for a full two hours on SCIENCE IN

THE CRIME LAB, explaining many of the detailed and clever scientific tests used in forensics, from footprints and fingerprints up to the most recent and still controversial DNA 'fingerprinting' techniques.

We'll soon be gearing up again for our annual trek to the University of Missouri research reactor on Nov. 8. While there we'll also visit the UMC Physics Research Labs, seeking brief 'snapshots' of current experimental physics work in progress. Because of the cooperation of the UMC Physics Dept. this has always been one of the highlights of this Fall field trip.

Our Nov. 22 slot is still unfilled, but possible topics range from mechanical engineering to scanning tunneling electron microscopy.

#### RECALLING A 1988-89 ENRICHMENT

As a follow-up, we recall here our exciting enrichment speaker of April 26, 1989, Dan Dumbacher from NASA, who has worked on testing the Space Shuttle Main Engines (SSMEs) for several years. He shared with us dramatic film footage of some of the more disastrous tests, as well as detailed and first-hand insights into the many difficulties of 'Going where no one has gone before'. Some of the 'incredible facts' he shared with us were:

- The SSMEs use liquid hydrogen for fuel at -423 degrees Fahrenheit, the second coldest liquid on earth, which when burned with liquid oxygen produces a temperature in the engines' combustion chambers of +6000 degrees Fahrenheit, higher than the boiling point of iron!

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- The maximum equivalent horsepower developed by the three SSMEs is just over 37,000,000 horsepower!

- If water, instead of fuel, were pumped by the three SSMEs, an average family-size swimming pool could be drained in 25 seconds!

We hope again this year to have a speaker from either NASA, or perhaps from the Jet Propulsion Lab to speak about the thrilling Voyager II mission.

As a final note, former MPI enrichment speaker astronaut Michael McCulley, who spoke to the 1985-86 MPI class six weeks after the Challenger disaster, will pilot the Atlantis on the next Space Shuttle mission scheduled for Oct. 12. The goal of this 31st shuttle mission is to launch the Galileo probe, a robot craft designed to orbit Jupiter and drop an instrument package into its atmosphere. Good luck, Michael!

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#### THE MPI TEACHING LOG

This year in our continuing attempt to entice our students into regular studying, and to gauge their progress, we have instituted a regular series of quick one-problem quizzes. We give these two or three times a week in the first five to ten minutes of class, and immediately follow them with a quick discussion of the solution. Because there are so many, each quiz represents only a small proportion of a student's grade. The result so far is that students are receiving a constant stream of feedback on the quality of their work, without severe penalties for errors, and the brevity of the questions makes them quick for us to grade. This is still an experiment, but so far we are optimistic.

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#### STUDENT QUOTES 1989-90

"The MPI is a great alternative to high school. There is a lot more freedom. The classes are harder but much more rewarding."

Jeff Thate  
Fort Osage High School  
Fort Osage School District  
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"Like many people at the MPI, I plan on going into engineering. So as far as college is concerned, I think this program will be a great head-start. I'm getting a feel of what classes will be like, so maybe college won't be such a shock."

Shannon Lundy  
Truman High School  
Independence School District  
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"The MPI is an excellent head-start for college. I knew this was the right step for me, since I plan to be an engineer. The challenge and experience of college courses in high school will be a valuable asset for college. I would recommend the Institute for anyone who has the tenacity to stick with it."

Raymond Rhodes  
Van Horn High School  
Kansas City, MO District  
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"First of all, I think I must be a nut to be a part of the MPI program, because it is very challenging ... to me that is! But I assume that this program is good for me in the long run."

Kim Nguyen  
Northeast High School  
Kansas City, MO District  
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A SOLUTION TO  
MATHEMATICS CHALLENGE # 10

Recall the problem statement:

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Given a 1 unit by 1 unit square and ANY five points inside it, PROVE that among these points there are at least two whose distance apart is  $\leq \sqrt{2}/2$ .  
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SOLUTION:

This problem allows us once more to see the versatile PIGEONHOLE (or, Dirichlet's) PRINCIPLE in action. Recall that it states essentially that if you try to put  $N + 1$  pigeons into only  $N$  pigeonholes, then at least one of the pigeonholes contains at least TWO pigeons. This is one more instance of a simple mathematical idea which has powerful consequences.

For our present problem, if we divide up the given unit square into four equal, smaller squares (using one horizontal and one vertical line), of any five points lying in the original unit square necessarily TWO (by the Pigeonhole Principle) must lie inside one of these smaller squares. Within such a square, the FARTHEST apart these two points could be would be the length of the diagonal. Since the length of a side of a smaller square is  $1/2$ , its diagonal has length  $\sqrt{2}/2$ , which yields us our solution.  
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MATHEMATICS CHALLENGE #11

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A friend of yours has a small opaque bottle containing 2 green olives and five black olives. The neck of the bottle will allow only one olive out at a time. He bets you that if you shake the bottle and then try to roll out the olives, you can't roll out the first three olives without getting a green one among them. Should you take the bet?  
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PHYSICS CHALLENGE # 1

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About three-fourths of the earth is covered with water. Imagine the earth reduced to the size of a billiard ball and dried with a towel. If you run your fingertips over the surface, would you be able to feel its mountains and ocean floors?  
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The MPI Newsletter is published five times a year on the first of the month during the months of August, October, December, February, and April at The Mathematics and Physics Institute, 600 W. Mechanic, Independence, Mo. 64050, phone (816) 276-1272. Please address all correspondence concerning this newsletter to 'MPI Newsletter'.  
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