

Director: Richard Waring  
Mathematics Coordinator: Richard Delaware

December 1, 1997

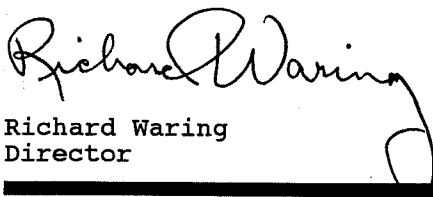
Vol. 12, No. 3

### OPEN HOUSE THANK-YOU

Fifty-six individuals attended our 13th annual Open House on Nov. 23. Included were 31 parents and relatives of MPI students, 22 students, 3 school administrators, and the entire MPI faculty and staff. This was a very good turnout since we had to compete with the Chiefs football game. I want to thank all of you for taking time from your busy schedules to see what is going on at the MPI. Your attendance demonstrated to your son or daughter a genuine interest in their activities and education. Your support has helped mold their priorities and goals. You have probably found that the demands and expectations at the MPI may be a new experience for your son or daughter. Your continued help, support and encouragement will contribute immensely to their success.

Although we believe everyone should have a solid basic understanding of mathematics and his/her physical environment, the study habits, reasoning ability and problem solving skills developed at the MPI are our highest priority, since these qualities carry over to other disciplines, and are essential in every productive individual. As we move, more and more, to a world economy, a solid education with well developed reasoning and problem solving skills is becoming a necessity.

Should questions about the MPI arise, please feel free to call.



Richard Waring  
Director

### TO ALL MPI ALUMNI:

#### HAVE YOU GRADUATED FROM COLLEGE?

IF SO:

PLEASE CONSIDER BEING  
AN ENRICHMENT SPEAKER  
OR JOINING OUR  
PANEL DISCUSSION!

[Tues. Jan. 6, 1998]

CALL (816) 235-1272

### ENRICHMENTS

#### FOLLOW UP

Oct. 10, Gisela Dreschhoff, a German Geophysicist, working with the Space Technology Center at the University of Kansas, discussed: **GEOPHYSICS RESEARCH IN THE POLAR REGIONS.**

Students responded:

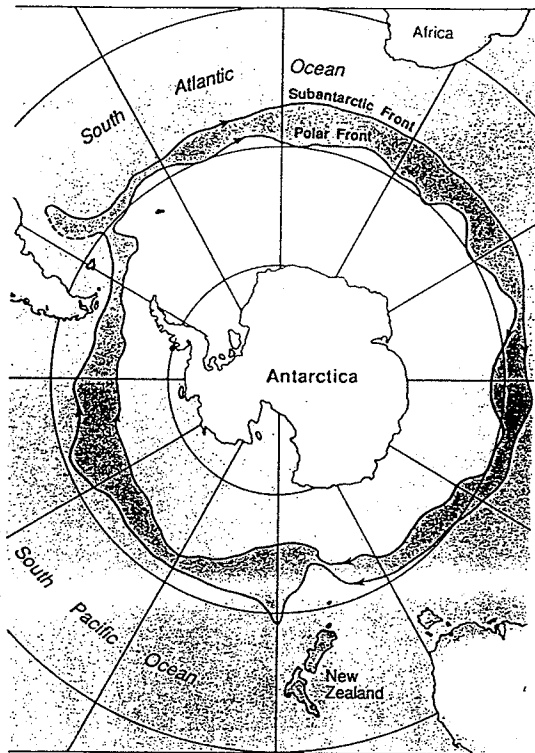
■ I've learned that Antarctica holds no life except around the coastal areas. There is also a magnetic field in the center of Antarctica where scientists are still doing research. Geophysics is an extremely interesting subject.

■ She explained to us how the study of ice and/or snow can help us determine what happened many years ago. She showed a lot of pictures of the station that she works at, and talked about her experiences at Antarctica.

■ Greenland is the only area left with ice from the Ice Age. Only the polar regions have magnetic fields

that almost go straight up into space. These magnetic fields cause the "Northern Lights." The ozone layer is made up of 3 gases, which needs the ultraviolet radiation from the sun, to be able to function together. The Arctic and Antarctica are deserts.

■ The enrichment was interesting and presentation was well thought out and planned. I liked it.



■ She went to Antarctica for the first time in 1976. You can study how glaciers move by the patterns they leave behind. Snow at the South Pole never melts so it can be analyzed to see what happened in the atmosphere in the past, for example, lots of radiation shows up when nuclear testing took place. Antarctica is a subject we don't usually get to hear much about in school - I enjoyed this presentation very much. I especially liked hearing about Ms. Dreschhoff's research.

■ In the summer months, the ice just doesn't melt away. The wind and waves break it apart and carry it away. The study of ice and snow is like studying the rings on a tree trunk. On the continent itself, geophysicists can study the ice to tell what happened in each year back over 3,000 years. I wouldn't mind

going to Antarctica.

■ Gisela was a very good speaker, she showed us all the exciting pictures. She is a very strong woman to do such things in the polar regions. She is such a brave woman.

■ She packed a lot of information into her speech. It was actually very interesting to learn about the happenings in Antarctica and the environment that we usually don't hear about in the news. I think it might be neat to go down there and be isolated for a while. I liked all the slides she had, it made it easier to understand what she was talking about.

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Craig Sundell, a paleoanthropologist at KU spoke on Oct. 24 about **THE REAL JURASSIC PARK: A WINDOW INTO PALEOECOLOGY.**

Students commented:

■ It was interesting to see the slides of the bones that they were finding, and to see the allosaurus claw (bone). He was a good speaker, funny - but he needs more killing and eating stories.

■ Talked about the types of bones and other fossils of prehistoric life he found. He passed around a cast mold of some claws and an egg. He showed slides of the sauropod (previously brontosaurus) that he dug up. This was a really good topic and probably is something everyone can relate to. Especially with that Jurassic Park movie that recently came out.

■ Talked about finding the dinosaur and how exciting it was. He did a good job of showing what kind of field work is done in his profession.

■ Sundell talked quite a bit about the camarasaurus and the fossilized remains he found in Wyoming. The camarasaurus' foot was very similar to the feet of today's elephants. Allosauri, the T-Rex of the Jurassic Period, were capable of reaching 30 mph when running. Some dinosaurs had bird-claws that they could use to slash another dinosaur across the belly, then run away and wait for it to die, they then would eat it. This guy was pretty good.

■ In this lecture, I learned that the majority of large dinosaurs lived in

the Jurassic Period. The speaker talked about his trip to South Dakota, where he found the largest and most complete dinosaur with its baby. This dinosaur weighed approx. 60-80 tons (that is about 6-8 elephants. Elephants are a system of measurement.). This find also allowed them to study the PaleoEcology; when the mother died, the other creature, a crocodile, came to eat off her. This was a new experience for the speaker. I think we should go to KU and help him prepare the bones.

■ He found a camarasaurus baby and an adult (one of the three most complete skeletons ever found). It may be a new species. It is probably the biggest specimen ever found (65-70 ft long). A camarasaurus gets its name from its vaulted skull (camara=vault). The scapula is the key bone used to identify camarasaurus.

■ I enjoyed this speaker, he kept it fun and seemed to be very excited about what he does.

■ He explained some of the procedures used in locating, extracting, and preserving the remains, as well as some of his theories about how the dinosaurs lived and functioned. Overall, the talk was interesting and informative. The slides gave a good visual example to watch while he spoke, and it was nice to be able to pass around and examine his examples of dinosaur remains.

■ He is a very funny guy, and also a very good speaker. He taught us a lot of things about dinosaurs.

■ Mr. Sundell was very well prepared and he seemed very interested in his work. He was a terrific speaker and used humor to grab out attention. However, he stayed serious and presented the topic well.

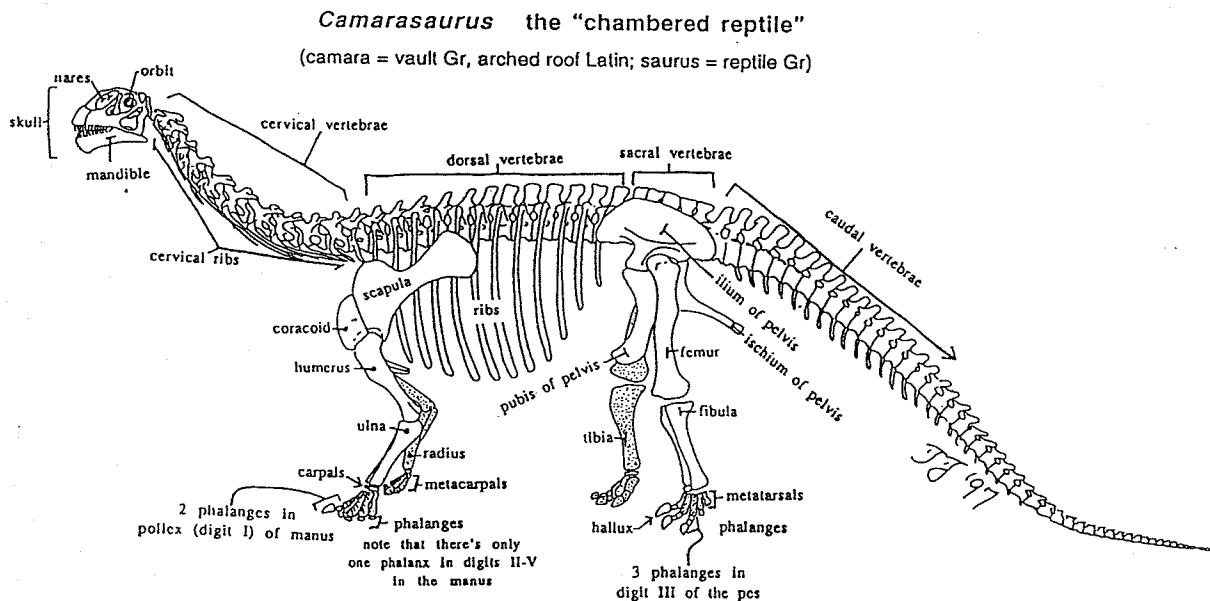
■ He's a good speaker which caught everybody's mood. We were having a fun time.

■ He talked about how the paleontologists find dinosaur bones. He had some really neat casts of bones - teeth, a claw, and an egg. He also had a good slide show, with neat pictures of an actual excavation. He did a good job in showing how huge dinosaurs actually were. He also told us how many things we think about dinosaurs might not be true - we actually know very little for sure about dinosaurs.

On Nov. 7 Sam Gill, an instructor in Critical Thinking at Johnson County Community College, returned once more to talk about **UNSOLVED MYSTERIES**.

Some student comments were:

■ Our speaker was one of the more interesting of all the speakers so far. First he described the scientific method, told us how people have proven their claims. He told us about UFO sightings.



■ He explained the process of scientific reasoning, observe, theorize, predict, test; the scientific method. After this he discussed how and why these processes apply. He gave us a sheet asking whether we think certain things happen. After that he reasoned out and discussed the topics. The speaker was humorous and chose an interesting topic.

■ This talk was very good. The subject was excellent. Everyone likes to know about aliens, it makes people curious. I thought this time was one of the best yet. I would definitely ask him to come back.

■ Your type of claim requires the same kind of proof. Proof has to be shown by the claimer. Science and scientific methods help save our political freedom, because of objective reasoning. Discussed that "I said so, it must be true", philosophy is gone. To the scientific method we discussed seeing UFO's. Four people in the class had seen one. We discussed the proof that the claimant had seen one. I think we need more time to discuss this. It has been one of the best ones yet next to Mitch Dobson. It made me rethink some of my opinions on far-fetched happenings.

■ Ordinary claims require ordinary proof; extraordinary claims require extraordinary proof. The burden of proof is always on the claimant. Ad Vericundium arguments are those that go "I say it, so it must be right". Ad Hominem arguments are those that go "He says it, so it must be wrong". We discussed controversial issues like government conspiracy theories, aliens visiting our planet, and the Bermuda Triangle, and looked at arguments for or against each idea. You always have to ask how good a person's evidence is.

■ Gill was an excellent speaker because he got people to think and question their beliefs by bringing up controversial issues of: aliens, conspiracies, bigfoot, and the Bermuda Triangle.

■ Sincerity is not evidence; conviction is not proof.

■ I liked the work sheet, he created a buzz, an interest in unsolved mysteries. That was neat. He made us think and question our government,

beliefs, etc. I liked that he actually interacted with us and didn't just lecture for an hour.

■ This was a good subject, a lot of thought was stirred by it, which is good.

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Finally, on Friday, Nov. 21, we made our annual all-day field trip to the **NUCLEAR RESEARCH REACTOR** at the University of Missouri-Columbia campus. Here are some student thoughts:

■ Got to see the reactor, tour guides explained the purpose of radiation and its uses. At the Physics Building we saw a preview of college physics; atomic microscopes, x-ray, and infrared studies.

■ They told us what kind of research they do there, and then we got to see the reactor, with its characteristic bright blue glow. That part was really neat. The, we went over and toured the MU Physics Department. They told us what they do there - spectroscopy, for one thing. They also showed us some neat images from a scanning-tunnel microscope. Then, we ate lunch and took another 2-hour (plus) bus ride home.

■ First we went on a tour of the nuclear reactor, which had a really pretty blue color. I did learn that clear topaz is put into the reactor to draw out the blue color by scrambling the electrons. Next we headed to the Physics Building and a few professors spoke to us about what they do. In another section we saw how we could make microscopic pictures of the surface of an object to see where atoms rise up and down to give texture.

■ I was surprised to find out that 50% of the topaz supply, I think in the world, comes from MU. I enjoyed touring the reactor and seeing the "blue glow." I never realized how many precautions are taken in a facility like that. There were so many radiation detectors and the pressurized chamber, and I kind of understood the theory behind it. We also toured the Physics Building at MU. A lot of the things lectured during this part of the tour kind of went over my head. It was pretty interesting to see all of the different, more complicated instruments used in their physics

department for experiments.

■ I have seen something that I've never seen before. I've learned that the radiation that is emitted by some elements has benefits not only for producing electricity, but also curing diseases, and to change the appearance or properties of other materials.

■ We went on a trip to MURR, it has the largest nuclear reactor that is used for research in the United States. They showed the pool to us and explained how it glows blue. They then showed us how they grow crystals in weightlessness to make them near perfect.

#### UPCOMING

Dec. 5 brings us Frank Booth, from the Kansas City Regional Crime Laboratories, with his very popular **SCIENCE IN THE CRIME LAB** talk.

On Jan. 6 we will once again host previous students of the MPI in our **PANEL DISCUSSION AND REUNION**.

For our Jan. 30 enrichment, we have not confirmed a speaker as of this printing.

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

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

**\*\* NEW \*\***

- (86-87) Maria Aguilera Butkovich  
butkov@sky.net  
BURNS & McDONNELL
- (86-87) Eric Butkovich  
butkov@sky.net  
BLUE SPRINGS, MO
- (88-89) Tammy Phelps Tandy  
jptandy@sound.net

#### WE HEAR FROM PAST STUDENTS

- (86-87) Maria Aguilera Butkovich  
(BS Chemical Engineering)
- (86-87) Eric Butkovich  
(BA Political Science, JD Law)

E-mail received 10-9-97:

"We were both Section C students at MPI during the year 1986-87. We were married on November 6, 1993. We live in Blue Springs, Missouri. We have three little girls: Slava, Nina, and Lazarina. They are smart. In particular, they understand the basic principles of physics, math and politics! Maria works at Burns & McDonnell as an environmental engineer, specializing in air pollution regulatory work. Eric is a prosecutor for Blue Springs, Missouri. It is very interesting work. Eric also does some criminal defense work on the side, including fixing traffic tickets in other jurisdictions. MPI was excellent preparation for college. The Raytown School District was absolutely stupid for quitting the program. It seems that football is more important to them. By the way, you should target the Blue Springs School District for participation in the MPI program too, so that our kids can go there in the future."

(88-89) Tammy Phelps Tandy  
(BS Biological Science)

E-mail received 10-9-97:

"Probably thought I had disappeared off the planet, didn't you? I'm writing on my husband's address, because I don't have one, though I'm sure he's about ready to get me my own account because I've been gabbing too much. Anyway, I just wanted to let you know that things have changed around our house quite a bit. We have a 19-month old son, James, and another due in March. Believe it or not, all my years of studying are helping out in some ways, namely organization and prioritizing. Being a mom is great though it is wearying at times. The best thing is passing on all this knowledge I have acquired to James. He is an eager learner. OK, he doesn't understand differential equations yet, but he does have trajectories down (throwing balls, blocks, pacifiers, cups, etc.). At the rate he is going, you may have him as a student by the time he is ten. He already knows by sight and says his ABC's! We're working on numbers and phonics now.

I felt really old when I got

the last letter and saw that it was year 14 and I was a part of year 5. My only regret is not taking Calc 1 AND 2. Oh well, you tried to talk me into it, but Vanessa and Sean and Nate were all convinced it was too much for a Senior year.

I have three cello students over at Music Arts Institute (MAI) and I am trying to keep up playing in Independence Symphony... Well, gotta go to bed. James is sick and has been up 3 of the last 4 nights. I need some rest!

Hope all is well with you. Write back!"

Sincerely,  
Tammy (Phelps) Tandy

**MPI E-MAIL ADDRESS:**

`rdelaware@cctr.umkc.edu`

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

**MORE 1997-98 STUDENT IMPRESSIONS**

"When you get to see things in labs and on computers it makes the concepts a lot easier to grasp."

**Tim Gengler**  
Fort Osage High School  
Fort Osage School District

"To study or not to study? ....that is the question. Study... study HARD!!! ....that is the answer."

**Sherise Massey**  
Central High School  
Kansas City, MO School District

"7 AM - I walk up 59 stairs to the MPI to learn calculus and physics. So far I've learned how long it takes a satellite to go around the earth, how much a person weighs when the elevator goes up, plus lots of other neat stuff. At 8:45 I walk down those 59 stairs with other MPI'ers and past the Police

Academy guys. We talk about velocities, Newtons, joules, limits, derivatives, etc... I feel pretty smart because I actually understand. It's a good feeling. I'm glad we're fortunate enough to earn college credit."

**Alicia Siy**  
Wm. Chrisman High School  
Independence School District

"My first impression of  $M\pi$ ? I thought it would be kind of difficult, especially at 7:00 in the morning. The first few weeks, calculus seemed harder than physics, but now it seems like physics is harder than calculus. I never had a math or science class that challenged me mentally until I came to  $M\pi$ . I'm also not used to doing a lot of homework outside of class for math and science. I have enjoyed calculus so far and the teachers here are helpful."

**Anissa Kincaid**  
Fort Osage High School  
Fort Osage School District

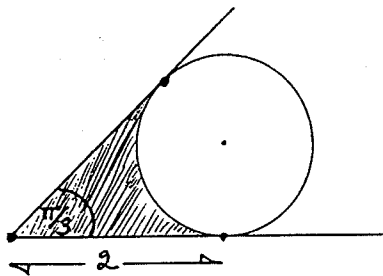
"As we approach the end of the first semester at MPI, I find myself in a different situation than I have ever experienced before. For the first time ever, I have to study the material before a test. For the first time ever, I find things difficult to understand. For the first time ever, I have to ask questions about the assignments. For the first time ever, I am struggling. Hopefully, I can overcome these hardships and begin to prepare myself for future struggles. And for the first time ever, I must."

**Adam Lipps**  
Wm. Chrisman High School  
Independence School District

**A SOLUTION TO MATHEMATICS CHALLENGE #50**

Recall the problem statement:

Suppose a circle is lodged in a  $\pi/3 = 60^\circ$  angle corner as shown:



Find, both exactly, and approximately to 4 decimal places:

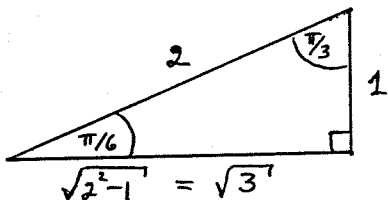
- The radius "r" of the circle, &
- The area of the shaded region.

**SOLUTION:**

First recall that

$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2} = \frac{\text{opposite}}{\text{hypotenuse}}$$

so, in a generic right triangle we have:

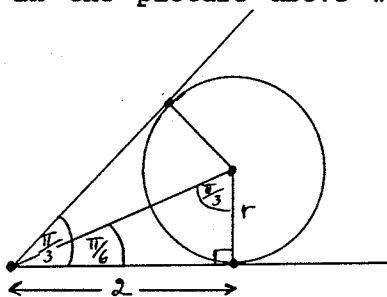


In particular,

$$\tan\left(\frac{\pi}{6}\right) = \frac{\text{opposite}}{\text{adjacent}} = \frac{1}{\sqrt{3}}$$

- The radius "r" of the circle:

Remembering that the radius of any circle meets the circle in a right angle, in the picture above we see that:



so that:

$$\frac{r}{2} = \tan\left(\frac{\pi}{6}\right)$$

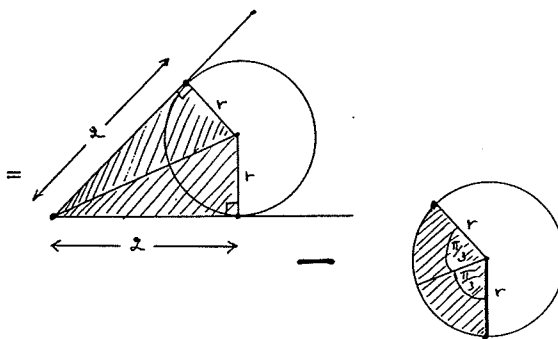
$$= \frac{1}{\sqrt{3}}$$

$$r = \frac{2}{\sqrt{3}} \text{ (exact)}$$

$$r \approx 1.1547 \text{ (approx.)}$$

- The area of the shaded region:

Area of the shaded region



= (Twice the area of one triangle)  
- (Part of the area of the circle)

$$= 2 \cdot \left(\frac{1}{2} \cdot 2 \cdot r\right) - \left[\frac{2 \cdot \frac{\pi}{3}}{2\pi}\right] \cdot \pi r^2$$

$$= 2r - \frac{\pi r^2}{3}$$

Since from part (a) we know  $r = \frac{2}{\sqrt{3}}$ , continuing:

$$\text{Area} = 2 \left(\frac{2}{\sqrt{3}}\right) - \frac{\pi}{3} \left(\frac{2}{\sqrt{3}}\right)^2$$

$$= \frac{4}{\sqrt{3}} - \frac{4\pi}{9} \text{ (exact)}$$

$$\approx .9131 \text{ (approx.)}$$

**A SOLUTION TO  
PHYSICS CHALLENGE #41**

Recall the problem statement:

To the nearest power of ten, estimate the number of iron atoms in the head of a pin.

[From: Physics Olympics Handbook]

**SOLUTION:**

To the nearest power of ten the atomic mass of iron is  $10^2$  g/mol, so one mole of iron has a mass of about  $10^2$ g. (This is a little high since the actual atomic mass of iron is 55.89/mole.) One mole of any substance contains about  $10^{23}$  atoms (this is a little low since the actual number is  $6.02 \times 10^{23}$  atoms/mole). The mass of the head of an iron pin is certainly less than one gram, but probably not as small

as one hundredth of a gram. So we will estimate the mass of iron in a pin head to be  $10^{-1}$ g. Thus:

$$\frac{\text{The number of iron atoms in a pin head}}{\text{Mass of a pin head}}$$

$$= \frac{\text{Number of atoms per mole of iron}}{\text{Mass of one mole of iron}}, \text{ so,}$$

The number of iron atoms in a pin head

$$= \frac{(10^{23} \text{ atoms})(10^{-1} \text{ gm})}{10^2 \text{ grams}}$$

$$= 10^{20} \text{ atoms.}$$

### MATHEMATICS CHALLENGE #51

Notice in the following table that the last digit of  $n^5$  seems to be the same as the last digit of  $n$ :

n	$n^5$
1	1
2	32
3	243
4	1024
5	3125
6	7776
.	.
.	.
.	.

Prove that this is always true for all  $n = 1, 2, 3, \dots$

[From: Challenging Problems in Algebra, by Posamentier and Salkind, 1970.]

### PHYSICS CHALLENGE #42

To the nearest power of 10, what is the ratio of the kinetic energy of the earth in orbit to its kinetic energy of spin on its axis?

[From: Physics Olympics Handbook]

Editor/Writer: Richard Delaware

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