



Director: Jennifer Snyder
Associate Director: Richard Delaware

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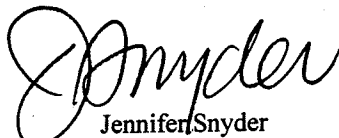
OPEN HOUSE THANK YOU

We had an excellent turnout for the MPI Open House this year. There were 69 people who attended the November 5th event. A total of 23 MPI students and 7 staff greeted the 40 parents and family members 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 3, 2001
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!!!**

TO ALL MPI ALUMNI:

**HAVE YOU GRADUATED
FROM COLLEGE?**

IF SO:
PLEASE CONSIDER BEING AN
- **ENRICHMENT SPEAKER** -
CALL (816) 235-1272
or contact us at:
mpi@umkc.edu

MPI Alumni who have spoken:

Doug Bullock	(84-85)
Brent Harding	(84-85)
Pam Deters/Stephen Koop	(84-85)
Seth McMenemy	(88-89)
Tony Thornton	(88-89)
Mitch Dobson	(89-90)
Rachel Allen	(92-93)

ODDS AND ENDS

To present the 1999-2000 MPI Academic Year Report, on **October 24** Jennifer Snyder and Richard Delaware met with UMKC Dean of Arts and Sciences Bruce Bubacz, Blue Springs Superintendent Paul Kinder, Fort Osage Superintendent Paul James, Independence Superintendent David Rock, UMKC Physics Department Chair David Wieliczka, and UMKC Mathematics and Statistics Department Chair Bruce Wenner.

As **November** began, we started to collect money for the MPI T-shirts and sweatshirts.

On **November 8**, one of our MPI students, Melinda Musil, suffered severe injuries in a car accident and has been in the hospital since then. Thankfully the latest news is that she is out of Intensive Care and beginning to recover. Our thoughts are with her. We miss her and need her back – her friends here want to discuss Calculus and Physics!

From **January 8-11, 2001**, both Jennifer Snyder and Larry Harding will attend the annual AAPT (American Association of Physics Teachers) conference in San Diego, CA. Jennifer Snyder will be presenting a paper there.

From **January 9-14**, Richard Delaware will attend the annual AMS/MAA (American

ENRICHMENTS

FOLLOW UP

On Friday, **October 6**, paleontologist and dinosaur hunter Craig Sundell of KU spoke on **THE REAL JURASSIC PARK: A WINDOW INTO PALEOECOLOGY**.

Students responded:

■ He is a vertebrate paleontologist at KU. He studies fossils. He says the earth is about 4.2 billion years old and that the universe is about 15 billion years old. The Earth is always changing. He said birds do not come from dinosaurs. He found a Tyrannosaurus Rex in early summer of this year.

■ I believe that the speaker performed very well. He was well prepared and answered questions very well.

■ He was great!!!

■ Very interesting. He was able to convey his meanings and not be too technical.

■ It was actually a very good discussion and added much theory to my understanding. It had a good balance of evidence and abstract extrapolation.

■ I thought he was a very good speaker, and I wish we had more time to spend with him.

■ Very enthusiastic! I talked about him for days!

■ My only suggestion for this enrichment would be that we had more time. Mr. Sundell had many things to share, and we were all interested. There just simply was not enough time to hear and see it all.

■ It was awesome.

■ I wish I could see more about dinosaurs. I want to see the bones; the head; or something like that. And talk about how they can find the bones of a dinosaur.

■ I like the word "crispificate."

On Friday, **October 20**, Ed Kiker, who had planned to speak on **FLASHLINE: THE MARS ARCTIC RESEARCH STATION**, was unfortunately called away to his office and was unable to appear at the MPI that morning. It turns out that he is leaving the area, and we will lose one of our most popular and inspirational speakers. Over the years, Ed has given ten talks at the MPI, listed below by MPI year. (We are now in our 17th year.)

- Year 7 - Industrialization of Space
- Year 8 - Moon Base Design
- Year 9 - Return to the Moon: When & Why?
- Year 10 - Lunar Mining & Space Transportation
- Year 11 - Energy From Space
- Year 12 - Outer Space as a Change Driver
- Year 13 - Future Studies
- Years 14 & 15 - Our Future in Outer Space
- Year 16 - Mars Base: Our Next Frontier

Ed emailed us his farewell on **November 14**:

"Giving the talks at your classes has been very instructive for me. I feel very bad about this last one, though, being called in to the office at the last moment as I was coming to it, to acknowledge selection for a new job and start the acceptance process. The past two weeks have been horrendous, with five days at Colorado Springs, huge amounts of paper to work with, security clearances, travel and household goods movement arrangement, and all with no notice.

You remember how much I liked working at the Army Space Institute, then how much I disliked the last seven years doing unit documentation when Army space efforts were downsized. Just a glorified, high-paid clerk checking lists of personnel and equipment for Military Police and Chemical units. However, and **this is for the benefit of your students**: I used my own time to stay current in space affairs, kept my networking up, made sure that my name was still familiar throughout the space community by personal contact and publishing in Military Review, Discover, and other venues, and it finally paid off. My new job is General Engineer with the Technical Support Office (three people: me, a more senior Science Advisor, and a secretary,) giving technical advice on future technologies as they pertain to space directly to the Commanding General, Army Space Forces. I came up smelling like a rose because I never gave up. The job is 40% travel, all over the world. I cannot wait to get to the Springs to start.

My best wishes to you and your students. Please remind them to be on the cutting edge of their fields, the very edge of the possible - not quite crackpots, but always close to it, looking for the wildcards that will change everything in a fundamental way. We have

already demonstrated teleportation of information, simulations of carbon fullerene tubes indicate that a cable from the Earth to space may be feasible, the Air Force is putting some real serious money into developing a space warp drive based on the Alcubierre equations, and there is much more. Our future is just shimmering with promise. Together we can make wonderful things happen.

Ed Kiker"

On Friday, **November 3**, Darrin Ingram, a project manager and senior associate at Gould Evans Goodman Associates Architects, and member of the American Institute of Architects, spoke on **ARCHITECTURE: DESIGNING THE ENVIRONMENT**.

■ He went over the process for building design and then went on to the process for constructing the buildings. He showed us some of the construction projects his firm designed. Darrin then went over the math and science someone would need to become an architect and we then asked questions.

■ Great speaker!

■ It was very informative and interesting. I am interested in architecture, especially sports architecture.

■ The slide show was an excellent support for the presentation. The speaker was informative and interesting. He answered many questions for everyone. I think everyone learned something different.

■ He was a good speaker. He stayed on the subject and related it to our lives.

■ Very good. Interactive presentation was good. He was very eager to answer our questions.

On Friday, **November 17**, Carr Everbach of the Department of Engineering at Swarthmore College, Swarthmore, PA, spoke on **WHY ULTRASOUND COULD KILL YOU OR SAVE YOUR LIFE**.

Students commented:

■ Professor Everbach talked about how ultrasound can either save lives or kills people. Ultrasound has made great steps in health. It has helped pregnant women and people with kidney

stones. He demonstrated how a sine wave has nodes and antinodes and standing waves. Heart attacks, cancer and strokes are the leading causes of death and ultrasound can prevent these.

■ I honestly can't think of anything to suggest; sound is a subject I've always been interested in although I don't know much about it, so I really enjoyed this presentation and found it very informative.

■ The presentation was fantastic. It was the best yet. His subject matter was very interesting and he made it "cool."

■ This guy was awesome! He's my hero!

■ He vividly described his job, what it entails, his education, and other aspects of MRI's and CAT Scans. It was very interesting to hear about what happened on the cellular level during an ultrasound. He thoroughly explained many uses for ultrasound, including monitoring unborn fetuses, inspecting damaged joints and detonating kidney stones. That was my favorite part – talking about cavitations.

■ I enjoyed this enrichment very much. Carr was very thorough.

■ The human ear can hear from 20Hz to 20 kHz. If our ear could hear any softer noises, we'd hear background hisses from molecules. Acoustic waves carry energy through a disturbance. Acoustic waves reflect too. When a wave reflects back and overlaps, it creates a standing wave, with the stationary areas called nodes. Standing waves are very important in acoustics. Ultrasound can take pictures from inside the body using the "sonar effect" to show contour.

UPCOMING:

On **December 8**, Frank Booth, a forensic chemist from the Kansas City Regional Crime Laboratories, will return to speak on **SCIENCE IN THE CRIME LAB**.

Tuesday **January 3, 2001**, 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.

On **January 26, 2001**, Douglas Crawford, a molecular biologist who studies the molecular evolution of gene expression with UMKC's School of Biological Sciences will speak.

WE HEAR FROM PAST STUDENTS

Ahmad Latifzai (85-86)
(BS Chemical Engineering)

E-mail received 10/10/00:

"This is Ahmad Latifzai class of 95. After graduating from MPI, I attended the University of Missouri Rolla. I finished my studies there last December and received my B.S. degree in Chemical Engineering. Currently I work for Schlumberger Oilfield Services as a field Engineer. I am writing to say hello and see how everyone is doing.

Well, I have to get back to the busy world of work. I hope to hear from you guys in the near future.

Have a good day."

MPI E-MAIL ADDRESS:

mpi@umkc.edu

2000-2001 STUDENT FIRST IMPRESSIONS

"I was scared my first day of MPI. I didn't know many people, and I can become very shy when I don't know anyone. But then we were introduced to everyone, and they were really nice. But, I was still worried about how I would be able to handle the work involved. I had heard stories from friends that have attended in the past years, and they were making me apprehensive about my ability to handle this. After about the first week, I knew I could handle it though. The work wasn't too bad, and it was actually starting to be fun. I am really glad that I came this year."

Michelle Warrington
William Chrisman High School
Independence School District

"When I first came to MPI, I was overwhelmed. I never had trig and that made it very hard for me. But the teachers helped me a lot with

some videos, the tutoring sessions and in problem solving. I even had a few study sessions with Melinda Musil. It has gotten easier since then. Basically, my first impressions were 'I can't do this.' And now it looks like 'I can try.'"

Jeni Landry
Van Horn High School
Kansas City, Missouri School District

"When I took the test to qualify to get into MPI, I wondered what it was going to be like. I remember thinking how much time I would have to devote to studying. My sister had previously taken MPI. [Tabitha Hanson, MPI 98-99] She had friends over all the time. They came to study. They would have discussions all night. They told me of the challenges of MPI.

The first day of MPI, I thought I was going to be different than everyone else. Almost everyone here is the same. There are some weirdoes. But I will talk about that later. When we met the teachers they seemed enthused to teach us. They were very eager. They taught with all their might. The teachers go through the material very quickly. It is because it is a college class. They are just doing what every college class is doing (I think?).

Some of the things I like about MPI is the teamwork. You can work together on your work if you need help. You also get the chance to meet new people. There are many different people here. It is interesting. At MPI, they give you a lot of freedom. When you do your labs you are free to do whatever you want. Labs let you get involved rather than listen to lecture or read a book. This is a good thing which prevents boredom. This also gives you experience of what college will be like.

I am not saying MPI is easy. It is very difficult. You have to make sure that you study constantly. It takes hard work to succeed at MPI. The pace of learning has to be quick. You also have to get up early every morning and be at class at 7:00am, which is probably the hardest thing to do."

Nehemiah Hanson
Ft. Osage High School
Ft. Osage School District

"MPI has proven itself to be a very challenging program for those involved. It pushes our thinking to a new level that can help us in all areas. All we need to do is keep with it."

Scott Domsch
Lutheran School
(Kansas City, Missouri School District)

"The word MPI scared me like no other. I was alright until the summer newsletter came. Then the panic set in. "What possessed me to sign up for this?!" But, staying calm, I bravely climbed the stairs to the Truman campus building. And I climbed some more. And some more. I might fail both classes, but at least I was going to be in shape.

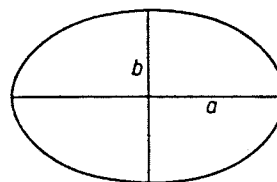
After three months of work, I've come to enjoy most of it. Now, several of you are cursing me right now, but is it really that bad? Sure, it's a little more work (for Calc I and II students, this is an understatement), but this is what it's going to be like for the next four or so years. Next year it won't seem so bad."

Josh Bergsten
Truman High School
Independence School District

A SOLUTION TO MATHEMATICS CHALLENGE #65

Recall the problem statement:

Suppose you are given an ellipse, as shown below, with major axis of length $2a$ and minor axis of length $2b$.

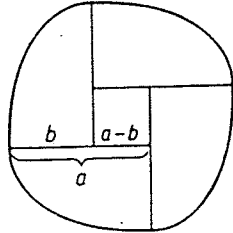


Draw another closed curve with exactly the same length as this given ellipse, but which encloses an area greater than the area of the ellipse by exactly $(a-b)^2$.

[From: One Hundred Problems in Elementary Mathematics, by Hugo Steinhaus, 1964, Dover, Problem #28, p. 18.]

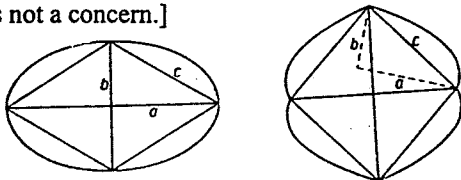
SOLUTION:

One way to obtain the required curve enclosing the specific larger area is to cut the ellipse, and thus the enclosed elliptical area, into four parts, and rearrange these parts as shown below. It is clear that these four pieces of elliptical area now surround an additional enclosed area of exactly $(a-b)^2$, as desired.



However, notice that the solution above requires that two of the four parts be lifted up out of the plane and flipped over.

A second way to obtain the required curve, which avoids removing any parts from the plane, is as follows. Connect the four vertices of the ellipse by four chords, as in the first picture below. Observe that therefore the Pythagorean Theorem gives $c^2 = a^2 + b^2$. Next, arrange the four outer elliptical parts as shown in the second picture below. [Think of the four vertices as hinges; imagine the central rhombus in the first picture is empty, and push together the left and right sides of the first picture to generate the second picture. Since the central rhombus is empty, "overlapping area" is not a concern.]



The enclosed area changes since although the areas of the four elliptical parts remain the same, the rhombus in the first picture, whose area is $2ab$, has been replaced by a square with area c^2 . This change is in fact an increase of exactly $c^2 - 2ab = a^2 + b^2 - 2ab = (a-b)^2$, as required.

**A SOLUTION TO
PHYSICS CHALLENGE #56**

Recall the problem statement:

This month's question is an estimating or order-of-magnitude question. That means that you should make estimates to answer the question and give your answer as an order of magnitude.

The question is: Approximately how many raindrops fall on a 1.0 acre lot during a 1.0 inch rainfall?

SOLUTION:

Let's assume that the raindrops are approximately spherical so that we can find the volume by $\frac{4}{3} \pi r^3$. Let's estimate the radius of a raindrop to be about a tenth of an inch (the question is in inches, so let's use that unit system). The volume is then $.004 \text{ in}^3$.

Now we need the volume of water on 1.0 acre with a depth of 1.0 in. 1.0 acre is 43.56 ft^2 , which is $6.27 \times 10^6 \text{ in}^2$. The volume is (1 acre) \times (1 in.) = $6.27 \times 10^6 \text{ in}^3$. The number of raindrops can be found by dividing the volume of water on the lot by the volume of one drop:

$$N = \frac{6.27 \times 10^6 \text{ in}^3}{4 \times 10^{-3} \text{ in}^3} = 1.6 \times 10^9 \sim 10^9 \text{ raindrops.}$$

If you liked that estimate, check out the new Physics Challenge below that MPI Group C did for homework this year!

MATHEMATICS CHALLENGE #66

On Day 1, Laura solved all the problems in a mail-in mathematical contest. Before sending her solutions by mail, she gave them to two student friends to copy by hand. On Day 2, these two students copied her solutions by hand. However, each of them made several (and different) errors in their copies. Then, in turn, these two students gave their copies to four other students to copy by hand (each of them to two other friends). On Day 3, these four students repeated the procedure, and this process continued.

Each new copy retained all the previous errors, and may have added new errors. It is also known that on some Day, each new copy will contain at least 10 errors.

Prove that there is a Day N, on which a total of at least 11 new errors are made in the copies.

[From: Quantum magazine, Vol. 10, No. 5, May/June 2000, p. 23, problem M291.]

PHYSICS CHALLENGE #57

McDonald's sells about 250 million packages of French fries per year. If these fries were placed end to end, estimate how far they would reach.

Editor/Writer: Richard Delaware

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