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### FIRST SEMESTER – TOP TEN

By taking the arithmetic 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. Listed alphabetically by schools, they are:

Aaron Scott.....Center Place Restoration

Tim Colyer.....Fort Osage

Dustin Sullivan.....Fort Osage

Alex Williams.....Fort Osage

David Winfrey.....Fort Osage

Jake Fulcher.....Truman

Reva Hertlein.....Truman

Chris Nevans.....Truman

Leslie Tiensvold.....Truman

Josh Tanner.....William Chrisman

### OUR NEW PHYSICS TEACHER

In August 2001, Russell Clothier joined the MPI faculty as a Physics teacher from Truman High School. He is the son, for those who live in the area, of well-known Independence pediatrician Bob Clothier. Russell, his wife and son have just returned from what he calls "exile" in West Virginia, a statement needing explanation. At the University of Missouri - Columbia (MU), Russell earned both his BS and Ph.D. in Physics, specifically in "Coherence Experiments with Neutron Matter Waves." He also worked for a time at the MU Research Reactor. After graduating, he took a position as Chair of the Physics Dept. at Bethany College in West Virginia in the foothills of the Allegheny Mountains. Although he enjoyed teaching and cycling at Bethany, he longed to return to Missouri. He decided that he wanted to teach younger students before they, as he says, "calcify", since all the teachers that mattered in his life were Middle and High School teachers. So, he

applied to and was hired by Truman High School here in Independence, thereby returning from "exile".

About his short experience working at the MPI, Russell has this to say:

"I feel extremely fortunate to have become associated with MPI. I thoroughly enjoyed teaching college physics, but felt a desire to work with younger students. MPI has allowed me to do both. The students are a teacher's dream: sharp, responsible, and as eager as teenagers can be at 7am. It's been a rewarding experience so far, and I hope to hang around at MPI for a long, long time."

We are very pleased to have a teacher of Russell's ability and enthusiasm contributing to the MPI environment, and hope he has a long stay with us. Welcome, Russell!

### 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](mailto: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

On **December 7**, the navy blue and gray MPI T-shirts and sweatshirts arrived.

On **January 10**, Sheri Adams attended a presentation at Blue Springs South High School by Rick Dufour on Professional Learning Communities, arranged through Central Missouri State University.

On **January 28 - 29**, we held our MPI Recruitment Days for juniors from participating school districts. (A report will follow in the April issue of this Newsletter.)

On **February 22**, Richard Delaware will give a talk in the UMKC Dept. of Mathematics and Statistics Expository Talks Series titled "Helge von Koch's 1904 paper on his famous 'snowflake' curve: 'On a Continuous Curve without Tangents Constructible from Elementary Geometry.'"

On **March 5**, Richard Delaware will act as a moderator and judge for the Second Annual UMKC HSCP (High School College Program) Mathematics Competition for high school students. He was also involved with the creation and review of the competition problems.

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## ENRICHMENTS

### FOLLOW UP

On Friday, **December 7**, Frank Booth, a forensic chemist from the Kansas City Regional Crime Laboratories spoke on **SCIENCE IN THE CRIME LAB**.

Students responded:

■ The layout of Kansas City Regional Crime Lab was described; the Drug Analysis Division, the Trace Elements Division, the Firearms and Tools Division, etc. Ballistics techniques, such as comparing rifling impressions, cartridge "striations," were explained, as well as how such techniques are used to obtain information. Similar techniques were explained involving tools markings, and matching physical evidence (such as shoeprints, bite marks, glass fragments, etc.). Details were also explained about fingerprinting, fiber analysis, and hair matching.

■ He talked about all the different ways in which evidence from a crime is analyzed. He showed us bullet samples and a carpet that had an invisible bloodstain that showed when he sprayed luminol on it. He also talked a little about DNA sequencing and the online network of cartridge

casings and fingerprints. Also, of interest was the fact that they only need 12 unique points on a fingerprint to identify someone.

■ Frank came in and showed how they use logic and technology to solve crimes. He showed slides of how they take evidence found at the crime scene, how they run tests on the evidence, and what the tests prove. If they find a bullet or a casing at the scene, and a gun on the suspect, they can prove the suspect guilty. If they fire the gun then compare that casing to the one at the crime scene and they match, then the person they found the gun on is probably guilty.

■ Overall the enrichment was a learning experience for me since I want to become a FBI Agent in the forensics department.

■ I would suggest bringing more of the crime lab. I want more hands-on experience next time.

■ I think it was a good enrichment, my favorite one so far. I liked how he described how they analyze the evidence exactly. It was very interesting.

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Our 17<sup>th</sup> annual **PANEL DISCUSSION AND REUNION** was held on **January 8<sup>th</sup>** in Room 207, and moderated by Richard Delaware. As usual, each of the panelists discussed their college experience, their major, and/or work experience.

The alumni panelists this year were:

**Holly (Buxter) Cruz (90-91)**  
BS Mechanical Engineering  
University of Missouri - Columbia

**Marlene (Toole) Vaught (94-95)**  
BS Biology, BA Psychology  
BA Interdisciplinary Studies  
(Chemistry, Childhood Reproduction)  
University of Missouri - Columbia

**Don Vaught (95-96)**  
BA Mathematics, BA Economics  
In Ph.D. Mathematics Program  
University of Missouri-Columbia

**Tim Dawson (96-97)**  
BS Mechanical Engineering  
University of Missouri - Kansas City

**Samantha Webb (96-97)**  
BS Biology  
University of Missouri - Columbia

**José Alcocer (97-98)**  
Civil Engineering Major  
Rensselaer Polytechnic Institute

**John Hershberger (99-00)**  
Chemistry Major  
University of Missouri-Rolla

**Michelle Warrington (00-01)**  
Photography and Spanish Major  
Central Missouri State University

**Luke Whorton (00-01)**  
Business Major  
Oklahoma Baptist University

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Other MPI Alumni attending were:

**Jerome Jennings (98-99)**  
University of Missouri – Columbia

**Kenneth Denton (99-00)**  
Atmospheric Science Major  
University of Missouri – Columbia

**Jamie Chapman (00-01)**  
University of Missouri – Columbia

**Adam Stickley (00-01)**  
Longview Community College

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Some specific current MPI student comments were:

■ The Alumni of the MPI talked about their experiences in college and different internships they were able to participate in. I spoke with Samantha, an intern working in the Police Dept. crime lab. She graduated from MU with a Bachelor's in Biology. Samantha really helped me with finding out what I need to do to become a forensics scientist. She also told me about what the FBI expects when applying for a forensics position, like so much experience, Bachelor's in Biology or Chemistry, and sometimes even a masters.

■ They talked about what they had gone through in college and what they are planning to do with the rest of their lives. They all seemed to work in how MPI helped them out. It was fun, I got to meet some new people and maybe even learn from their mistakes.

■ It was very relieving and inspiring to hear from people who have gone through MPI. Everyone stated what they were doing now and where they went or are going to college. It was nice hearing the different points of view on dorm life and the shock of being a freshman at college. I think that Luke

Whorton gave me some good advice when he said that its very important to buckle down and concentrate from the first day and not after midterm.

■ I thought it was really neat to see the diversity among people who went to the MPI, from engineers to business majors.

■ I feel this was a great enrichment seeing that many of the alumni took degrees in areas of our interest and we were able to socialize and asked questions with them.

■ It's great, I learned a great deal about college life from college students who graduated from MPI and have work experience in different fields.

■ This is the most useful enrichment yet and I was able to see what's going to happen in the future.

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#### UPCOMING:

We have not yet scheduled speakers for February 1 or February 15.

In March we'll take a two-part field trip to UMKC, separated by lunch, to visit both the **Physics Dept. laboratories** in the Flarsheim building, and the **Rare Book Room of Linda Hall Library of Science, Engineering & Technology**. In Physics, last year we toured labs in Atomic Force Microscopy, Scanning-Tunneling Microscopy, High Pressure Physics, Chaos/NonLinear Dynamics, Photoelectron Spectroscopy, and Photo-Luminescence. At Linda Hall Library, we viewed rare and historically significant mathematics books including the first calculus textbook (1696), books by Newton and Leibniz, co-inventors of the calculus, several versions of Euclid's Elements, and about 20 more books. MPI students will also be required to write a short response paper for calculus class.

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#### WE HEAR FROM PAST STUDENTS

**Pat Liang (86-87)**  
MD, Internal Medicine  
Emergency Medicine, SUNY-Upstate Medical University Hospital in Syracuse

E-mail received 11-29-01:

"Sorry for the delay in responding to the original reply. As you can probably tell, I don't read email but maybe once or twice per month!!!

Thanks again for allowing me to use you as a reference for my master's degree program.

It has been a long time since I have communicated with you and the MPI staff. Alas, I will not be able to join you on January 8, but here is what has been occurring in my life since we last spoke: My wife and I now live in the Syracuse, NY, area and have been here nearly 18 months. After completing my residency in Internal Medicine at KU, I decided that I wanted to return to the specialty I first wanted, but allowed persons close to me decide otherwise...Emergency Medicine. I am in the last of a two-year residency/fellowship in Emergency Medicine at SUNY-Upstate Medical University Hospital in Syracuse. We are the only level 1 trauma center covering the area east of Rochester and west of Albany and from the Canadian border southward into northeastern Pennsylvania. This means all of the bad accidents and burns from this whole region are brought to our hospital. I have taken a liking to this area because the hills and the trees explode with color during the fall and the summers are nowhere near as hot as in KC. Winter has taken some adjustments, but I remain undeterred. I am currently considering offers from each of the 4 hospitals in Syracuse to stay and practice. I am also applying for a master's degree in cardiovascular perfusion and the opportunity to do some research in that field as well as emergency medicine. I have also been moonlighting in the urgent care centers around the area.

I certainly miss all of you at MPI and will try to stop in when we return for our next visit to Kansas City. Until later!!"

Patrick Liang, MD

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**Holly (Buxter) Cruz (90-91)**  
BS Mechanical Engineering  
University of Missouri – Columbia

E-mail received 12-17-01:

"The concise version of my life and career since leaving the MPI: After graduating from Van Horn in 1991, I attended the University of Missouri-Columbia where I received my Bachelor of Science in Mechanical Engineering in December 1995. While attending MU, I worked as a Mechanical Engineering intern at the university's Research Reactor, where I met my now husband. After graduating, I moved to Texas, where we were married in August 1996. I accepted a position as Technical Sales Engineer for a company in Dallas, LGS Technologies. LGS Technologies is a custom fabricator mainly for the telecommunications industry. In my position, I would meet with buyers and engineers needing assistance in material specification and manufacturing of a product they had designed, or needed help designing. In April of 2000, my husband and I had a little girl, Tiarra. I continued to work for the next year, and celebrated

my 5-year anniversary with the company in February of 2001. However, I decided I didn't want someone else teaching her Calculus first (okay we're working on counting right now, but we'll get there!) and resigned from my position in April 2001. This was actually part of the reason for the move. My husband was able to accept a promotion/transfer that would allow me to be able to stay home full time without devastating our finances. I do plan to return to work, I thoroughly enjoyed my job and the company I worked for. We moved to Ottawa, Kansas, in August 2001.

Please tell Mr. Kaifes [a former MPI teacher] hello for me the next time you see him. Whether he knows it or not, he was directly responsible for my career path.  
Happy Holidays!"

Holly Cruz

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**Benetta Fairley (95-96)**  
University of Missouri – Columbia  
BA Psychology  
University of Georgia  
M.Ed Counseling Psychology Major

"Currently I'm a Master's Candidate at the University of Georgia applying for Ph.D. programs in Counseling Psychology – wish me luck.

MPI was a life-changing event for me – it opened my eyes to the information I did not receive as a high school student and made me aware of the challenge that I had ahead of me of not only trying to keep up but attempting to learn the information that was not presented to me in the past."

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**Thomas Gregory (96-97)**  
University of Missouri – Kansas City  
Pharmacy Major

"MPI is a great indicator of future college aptitude. Take your stay at MPI as the gift it is, enrich your skills of mathematics & physics, make this the beginning of a great college career."

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**Teresa (Schlueter) Orth (96-97)**  
Northwest Missouri State University  
BS Biology: Cellular & Molecular Emphasis  
University of Kansas School of Medicine  
Medical Student

"My husband, Michael Orth, and I were married on May 12, 2001. I am a first-year medical student at KUMC enrolled in their M.D./Ph.D. program. MPI was a valuable experience for me because it helped me to remain focused during my senior year of high school. MPI also taught me about the demands of college and what the term "FINAL"

actually means. My instructors were also very enthusiastic (even at 7am), which facilitated my interest in the subjects and helped to keep us awake. Thank you for this wonderful opportunity to challenge myself and boost my education before college.

On a more specific note: I remember college physics to be very fast paced at my undergraduate institution, but the solid foundation I received at MPI helped me to fall back on basic skills and teach myself how to navigate the course successfully.”

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**Samantha Webb (96-97)**  
University of Missouri – Columbia  
BS Biology

“I am currently interning at the KCPD Crime Lab and my internship will probably be over in Mid January. I may attend grad school in the fall depending upon the job market in criminalistics. Hope to talk to you all soon!”

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**Daphne King (97-98)**  
University of Missouri-Kansas City  
Civil Engineering Major

“It really helped me to get an idea of what to expect. I truly think the MPI courses were more difficult than the first few math courses taken (College Algebra, Calc I, Calc II, Calc III, Diff Eqns).”

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**Jeremy Stayton (98-99)**  
University of Missouri – Kansas City  
Biology Major

“It [the MPI] has exceeded my college Calculus course immensely. In college I had a Ukranian guy who barely spoke English. He only worked the problems already worked in the book, and I did better not showing up! Ended up with a B in there, barely. Great Program.

Work hard and live, slack off and fail.”

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**Angelina Walls (98-99)**  
Creighton University  
Communication Studies Major

“They [MPI teachers] were much more interactive than my classes since then. The instructors at MPI are more concerned with the students and always willing to put in extra time. It taught me how to study. It showed me how fun learning can be. Just keep it fun. MPI was one of the best things I did in high school. If I had to go back to

high school, I’d do MPI all over again. It was fun and it taught me how to manage a heavy workload.”

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**Tracy Weber (98-99)**

“I regret having to inform you that my daughter Tracy was killed in an automobile accident near Bolivar, MO, on June 4, [2001], as she was on her way to Branson, MO. She had just gotten married 6 weeks before the accident. She had just completed her 2<sup>nd</sup> year of school at Avila College where she was studying to be a nurse. She still talked fondly of MPI and how much it had helped her. I’m sure she would have attended the reunion to see all of her friends and teachers. Thank you for all that you did for Tracy. She loved MPI and I know how much she thought it had helped her.”

Sincerely,

Chuck Weber [Tracy’s father]

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**Jeffery Weston (98-99)**  
University of Missouri - Rolla  
Computer Engineering Major

“While most courses here at Rolla COVER more material, you actually LEARN about the same amount. I went straight into Calc 3 at Rolla with no problem whatsoever. It definitely made college quicker and taught me to study. Keep up the good work. Awesome program.”

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**Heather Biggs (99-00)**  
Devry  
Electrical Engineering Major

“My MPI professors went into depth of why things worked and how it was derived. My professors now introduce the subject then give us the formulas and don’t explain too much about why it works. It has made my present Calculus courses much easier, and I hope that next trimester that my Physics course will be easier too.”

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**Kenneth Denton (99-00)**  
University of Missouri - Columbia  
Atmospheric Science Major

“The quality of [MPI physics] courses was identical with [college] physics. While taking mathematics at UMKC and MU, I believe the MPI quality was much better. Even though it went quickly, we still had classes with the instructor where we could ask them questions about a chapter instead of a TA and have conflicting answers.

Since I participated poorly at MPI, it affected me greatly. I noticed I still had questions

unanswered but thought I could solve them myself. Once realizing this was false, it was too late and I was very behind in the course. MPI was my wake-up call to college classes. How they worked, their speed, the material, and so on. I think if I did not attend MPI I wouldn't be pulling out a 3.0 at MU."

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**Sarah Piatt (99-00)**

University of Missouri – Kansas City  
School of Medicine  
Medical Student

"I haven't taken any math or physics since MPI but the quality of MPI was very good and the teachers were always there to help. Now in my classes the teachers don't have time to explain concepts to you."

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**David Smith (00-01)**

University of Missouri – Columbia  
PhotoJournalism Major

"Even though I didn't do it at MPI, I learned secluding myself to study for 2-3 hours per day is the key that I do here.

I tried to think like the teacher on my tests this year and how they would ask questions. I learned not to be nervous about tests because life goes on after it.

I received 8 hours of free credit [at the MPI] in extremely tough classes studying with students who were more intelligent than me."

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**Luke Whorton (00-01)**

Oklahoma Baptist University  
General Business Major

"For my major I'm only required to take Business Calculus so I don't have to take any [more] math. But I am and have been very well prepared to tutor other students currently in Calculus. I know more than enough to help them through their course.

I do feel that I learned a great deal from the MPI course. I learned to study until I mastered an objective than to just study for "x" amount of time.

I matured because of the challenges faced at MPI. I grew mentally as I was stretched beyond my boundaries and my study habits were improved."

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#### **MORE 2001-2002 STUDENT IMPRESSIONS**

"MPI is an obstacle course that I hope to one day complete. I am told these classes are for the cream of the crop and I now understand why. It takes

rigorous studying and working to succeed, and I am glad I have been put up to the challenge."

**Andrew Gibler**

Fort Osage High School  
Fort Osage School District

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"I thought MPI was going to be completely different. Everyone who heard I was considering going unloaded every horrible thing they knew onto me. I was debating it over and over again, but now I am confident in my decision. MPI isn't that bad. It requires more work (which I should probably start doing), but nothing I am incapable of. The worst part for me is getting someone to take me to and fro. I am beginning to think I will be riding the bus for the rest of my life. Oh well, overall I think this is best thing I could have done for my senior year. It has kept me on track, which I needed."

**Reva Hertlein**

Truman High School  
Independence School District

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"Thus far we have completed half the MPI school year and I must say I will be thoroughly euphoric when the remainder is completed. However, it has been a great experience to be able to come to the MPI, and amidst waking up before the sun rises and having killer Calculus tests, MPI does have its moments of fun (long live the CHALK MAFIA).

Advice, I have none\*see Calculus grade for Cameron, Jared\*, but if you have the chance to come do so."

**Jared Cameron**

Center Place Restoration School  
Forts Osage School District

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"The MPI has definitely been an experience. It has been a difficult and rewarding experience as well. I still think that getting up at 6:15am is the most difficult part of the MPI. At first I thought the MPI was going to be an impossible task. As the year went on, however, I realized that as long as I put out the effort to do well, I could do well. It is also rewarding that after MPI is over, I will be in very good shape for college. This is a result of my work, coupled with the great instructors at the MPI. The MPI is a great opportunity that I am very happy I capitalized on."

**Jake Fulcher**

Truman High School  
Independence School District

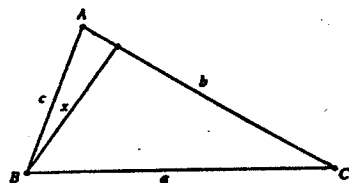
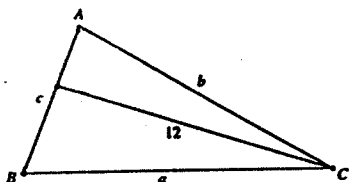
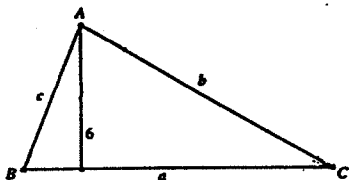
"So far MPI has been fun, even though it can be pretty challenging and rigorous at times (especially on test days). Getting up to get to school at 7:00 in the morning is one thing I still have not gotten used to. Overall, the MPI is a great thing and I have formed many new friends."

Andrew Brink  
Truman High School  
Independence School District

### A SOLUTION TO MATHEMATICS CHALLENGE #71

Recall the problem statement:

If two of the altitudes of a triangle ABC have lengths 6 and 12, prove that the third altitude,  $x$ , must exceed 4, meaning,  $x > 4$ .



[From: The 1990 Manitoba Mathematical Contest as quoted in Mathematical Chestnuts from Around the World, by Ross Honsberger, MAA, 2001, section 16, problem #18, p.179.]

#### SOLUTION:

First, using the fact that the area of a triangle is  $(1/2)(\text{base})(\text{altitude})$ , using the three pairs of altitudes and bases of triangle ABC in turn, we can write

$$(1/2)6a = (1/2)12c$$

$$a = 2c,$$

and similarly,

$$(1/2)xb = (1/2)12c$$

$$xb = 12c$$

$$x = 12c/b.$$

Second, by the Law of Cosines, since  $a = 2c$  from above, we have that

$$b^2 = a^2 + c^2 - 2ac \cos(B)$$

$$= 4c^2 + c^2 - 4c^2 \cos(B)$$

$$= c^2 [5 - 4 \cos(B)].$$

Since it is always true that  $\cos(B) > -1$ , we have

$$\cos(B) > -1$$

$$-4 \cos(B) < 4$$

$$5 - 4 \cos(B) < 9,$$

so that from above we conclude

$$b^2 < 9c^2.$$

$$1/9 < c^2/b^2$$

$$1/3 < c/b.$$

So finally,

$$x = 12c/b > 12(1/3) = 4, \text{ as desired.}$$

Note: If we generalize this problem, say replacing 6 by  $u$ , and 12 by  $v$ , and repeat the same argument as above, we conclude that the altitudes are related as follows:

$$x > (2u^2)/(u+v).$$

### A SOLUTION TO PHYSICS CHALLENGE #62

Recall the problem statement:

Let's move from the topic of momentum to optics...

Peacocks have no pigment in their feathers, unlike cardinals, bluejays, etc. Instead, they have microscopic ridges in their outer feathers. Can you think of the physical reason for the peacock's colorful appearance?

#### SOLUTION:

The physical principle responsible for the colorful appearance of peacock's feathers is diffraction. The ridges in the feathers act as a "diffraction grating", dispersing white light into its constituent colors (wave lengths). When viewed from any particular angle, the light waves "bouncing" from each of the ridges interfere with each other. These light waves will add to a higher amplitude if the peak of the wave from one ridge coincides with the peak from another, and this is called constructive interference. Likewise, the waves add to a lower

amplitude if the peak of the wave from one ridge coincides with the trough of the wave from another, and this called destructive interference. When viewed from a particular angle, some colors' light waves interfere constructively and the colors will be seen. Some colors waves interfere destructively and those colors will be absent. The net result is the appearance of beautiful colors.

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### MATHEMATICS CHALLENGE #72

Suppose a real number,  $x$ , satisfies all the inequalities:

$$2^1 < x^1 + x^2 < 2^2$$

$$2^2 < x^2 + x^3 < 2^3$$

$$2^n < x^n + x^{n+1} < 2^{n+1}$$

That is, for all  $k = 1, \dots, n$ , the number  $x$  satisfies

$$2^k < x^k + x^{k+1} < 2^{k+1}$$

What is the greatest possible value for  $n$ ?

[From: Gordon Lessells of Limerick University, Ireland, as quoted in Mathematical Chestnuts from Around the World, by Ross Honsberger, MAA, 2001, problem #8, p.277.]

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### PHYSICS CHALLENGE #63

Another example of colors seen in nature that are not due to pigment is the pattern of colors seen in oil or gasoline on water. Such spills appear with a pattern of yellow, magenta (pink), and cyan (greenish blue) rings or stripes. Can you think of the physical reason for the appearance of these colors?

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Editor/Writer:

Richard Delaware

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