MathPath

Mathpath Admissions
c/o Prof. Maurer, Math/Stat
Swarthmore College
500 College Ave
Swarthmore, PA 19081 USA

MathPath 2009
summer camp
for middle-school age students
showing high promise in mathematics

Application Mailing Postmark Deadline: April 30, 2009

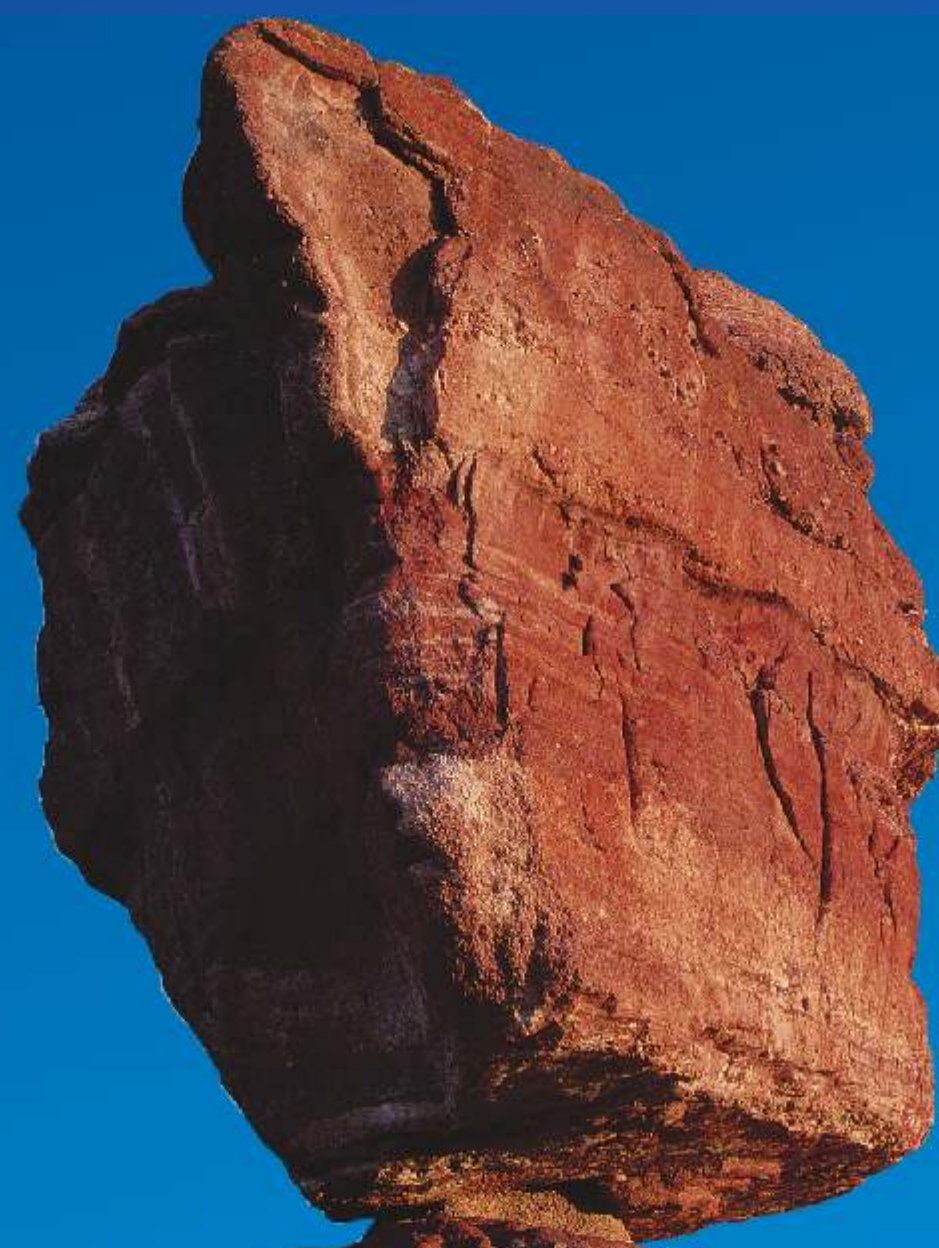
www.mathpath.org

Email: camp@mathpath.org

MathPath 2009

A Residential Summer Camp for Middle-school Age Students (11-14 years)
showing high promise in Mathematics

MathPath 2009 will be held on the campus of
Colorado College, Colorado Springs, CO
June 28 - July 26, 2009



“I got to be with boys and girls my age who love math as I do.”
Rachel Kirsch, Bethesda, MD (2002)

“Lots of cool people come here. In addition to being fun and educational you make lasting friends.”
Daway Chou-Ren, Holmdel, NJ (2007)

“The decision to permit my child to attend MathPath was one of the best decisions I've made for her.”
Komala Krishnaswamy, Sugar/and, TX (2003)

“Our son loved every minute of MathPath; his enthusiasm for math has turned into a passion.”
David and Kazuko Hogge, Rockville, MD (2004)

“MathPath is a place where really smart kids interact with real mathematicians and learn new and exciting math. Most middle school camps either stress preparation for contests or acceleration through the high school curriculum. MathPath is nearly unique in stressing deep mathematics that is not on the beaten path.”
from the anonymous post camp parent questionnaire (2008)

The balancing rock in the Garden of the Gods near Colorado College

MathPath® - "Bright & Early®"

MathPath 2009 Qualifying Test

Teachers may want to photocopy this test and distribute to students.

Please display the reverse side of this brochure on the school's Math Bulletin Board. You may want to make one fold to hide the mail panel.

Instructions

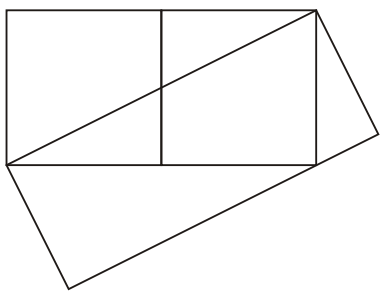
Please read the instructions and advice at http://www.mathpath.org/Quiz/MP09test.pdf

Do as many of the 7 problems as you can. If you can make good progress on at least 3 problems you should definitely apply! You may ask others to help you understand the statements of the problem, but the actual solutions must be your own.

1. Consider the pair of 3-digit numbers ABC and CBA, where A, B, C are distinct positive digits. Find all such pairs where both numbers are divisible by 7. (For instance, the pair 126 and 621 doesn't work, because 621 is not divisible by 7.)

2. You have a flat disk and a sphere, both with the same radius. If you hold each of them the same distance directly in front of you, which, if either, looks bigger? Explain. Be sure to make clear how you interpret "the same distance directly in front of you".

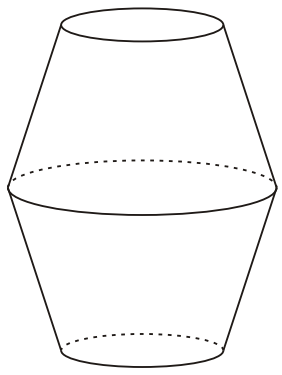
3. The two squares in the diagram below have side length 1.



a) Find the area of the slanted rectangle.

b) Generalize, with proof.

4. A pitcher has a vertical cross section in the shape of two congruent trapezoids glued together along their long parallel sides. Each horizontal cross section is a circle. See the figure. Water is poured in the top at a constant rate.



Sketch a graph describing the height of the water in the pitcher as a function of time. Explain how you got your answer.

5. Given n pebbles in a pile, split the pile into two smaller piles. Continue to split each pile into two smaller piles until there are n piles of size 1. At each splitting, compute the product of the two smaller sizes and keep a running sum of these products.

For instance, suppose $n = 5$. You could first split the pile into piles A and B of sizes 3 and 2. (Sizes 4 and 1 would be OK too.) The product of 3 and 2 is 6, which is your sum so far. Now you might split A into 1 and 2, for a product of 2 and a running sum of 6 + 2 = 8. Then you could split B into 1 and 1, for a product of 1 and a running sum of 9. Finally, split the remaining pile of 2 into 1 and 1, for a product of 1 and a final sum of 10.

a) Experiment with other ways of splitting piles of 5 and piles of 6. Record the final sum each time. Show your work.

b) Make a conjecture.

c) Prove it.

6. Prove or disprove:

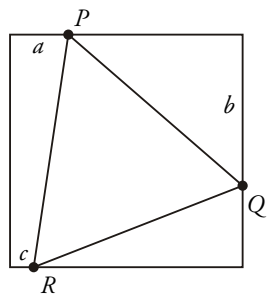
a) If the sum and product of two numbers are integers, then the two numbers are integers.

b) If the sum and product of two rational numbers are integers, then the two rational numbers are integers.

7. (Note: This problem grew out of a problem writing course at MathPath 2008.) A triangle is *inscribed* in a square if at least the 3 vertices of the triangle lie on the sides (or corners) of the square. Sides of the triangle may lie on sides of the square as well.

There are many ways to inscribe an *equilateral* triangle in a square of side 1. One such is shown in the figure below, where

$$a = \frac{1}{4},\quad b = 2 - \frac{3}{4}\sqrt{3},\quad c = \frac{7}{4} - \sqrt{3}$$



a) Verify that triangle PQR in the figure is equilateral.

b) Come up with an equilateral triangle inscribed in a square of side 1 that you believe has the maximum area among all inscribed equilateral triangles. Show that your triangle is equilateral and find its area.

c) Prove that your triangle in b) has the maximum area.

Why MathPath?

MathPath is the international mathematics summer program for extremely gifted middle-school age students. It differs in five important ways from the gifted summer programs run by Johns Hopkins, Duke, Stanford, and other universities:

I. The MathPath program is designed for "math persons"; everybody here is studying just math.

II. Unlike programs that are essentially courses in a subject, a MathPath student will engage in several strands of interactive sessions in mathematics during a four-week period and emerge from the program with a broader and deeper understanding.

III. While many programs emphasize acceleration, MathPath emphasizes enrichment - topics and methods of thinking that often don't appear in the school mathematics curriculum at all.

IV. Sessions at MathPath are led by distinguished professors who are experts in instructing mathematically very gifted middle-school age students.

V. MathPath is a welcoming environment for kids who are really good at math but are not necessarily good at sports, or social skills, or other things that ordinary kids do easily.

MathPath evens out the accessibility to enrichment programs suitable for bright students. For instance, a few universities and school districts offer special gifted programs, say, on Saturdays. Intensive summer programs can provide a well-rounded mathematical experience to students from all parts of the nation.

MathPath is also a place for students to improve their competitive problem solving. Courses on MathCounts and AMC exams are a regular feature. Depending on student and faculty interest, there are sessions on AIME, USAMO, Mandelbrot, etc.

Above all, MathPath is a summer gathering place for middle-school age students showing high promise in mathematics. Their greatest social need is to meet peers, and their greatest intellectual need is to receive the right challenge and reinforcement of their love of math. If you have a child or a student like this, please encourage him or her to apply!

The best thing about the camp

(Student responses from end-of-camp anonymous survey)

"The way the classes were arranged"
"Learning how to solve the Rubik's cube"
"Too many best things"
"Teachers, counselors, and staff"
"Doing math while having fun"
"Meeting other smart kids"
"Playing [famous Prof John] Conway at Dots and Boxes"
"The weekend trips!"
"Doing math!"

When to Apply

Application Postmark Deadline - April 30, 2009.
Late applications considered if places are available.

We encourage you to apply early. Applying early would allow you to plan your summer in advance as well as obtain cheaper airfares.

The admission decision on each application is usually e-mailed within 10 days of receipt. Those who qualify receive a registration form to complete and mail back with a fee deposit of $1000. Usually, the number of students who qualify is between 75 and 110.

How to apply

All instructions and forms are found at www.mathpath.org/apply.htm. You will need to submit the Qualifying Test, an application form, two letters, and a $20 application fee to our admissions address at Swarthmore College.

Student Care

At MathPath, the safety and wellbeing of our students, at camp and getting to camp, is a top priority. Here's what some parents said on our 2008 anonymous post camp survey.

"The counselors and professors are extremely committed to safety and emotional security. Our son traveled alone from Chicago for two of his three summers and was greeted upon arrival as planned. I had no worries at all. Our family is so grateful that MathPath exists."

"This is my child's first boarding summer camp ever and we didn't have any concern about the safety and wellbeing of my child during the entire camp. MathPath is a well organized and established camp, and we were well informed since the very beginning of what was going on in camp."

For details about our student care, see http://www.mathpath.org/care.htm

Camp Fees

The camp fee is $4500.
For details, see www.mathpath.org/fees/tuition.htm
Also see www.mathpath.org/fees/schol.htm for scholarships and financial assistance.

Travel to Camp

Students flying unaccompanied by parents must fly to Denver airport. See www.mathpath.org/gettingthere.htm.

For much more information, including faculty, guest speakers, daily schedule, more quotes and photos, see **http://www.mathpath.org.**