Training Gifted Students: The Fullerton Mathematical Circle Experience

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General Contributed Paper Session, MathFest 2013

- Mathematical Circles are a form of outreach that bring mathematicians together with K-12 students.
- These students, and sometimes their teachers or parents, meet together with a mathematician, undergraduate, or graduate student in an informal setting to work on interesting topics or problems in mathematics.
- These informal meetings are held outside of school hours, either at night or on the weekends.

Our Fullerton Mathematical Circle:

- First meeting - on September 24, 2011; meetings have been held on numerous Saturdays since in CSUF campus

- Our sessions' content is inspired from the experience of similar events developed around the monthly publication *Gazeta matematică*, a journal established in 1895

Additionally we covered problems from:

- Abacus International Challenge (students in grades 2-4 and students in grades 5-6)

- American Mathematical Competition (AMC 8, AMC 10, AMC 12, AIME, USAMO)

- Math Kangaroo

- Monographs published in the MSRI's Math Circle series
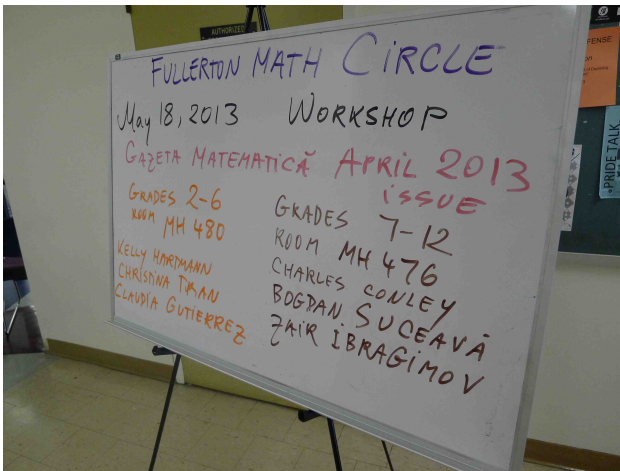
Our Fullerton Mathematical Circle schedule in a workshop day.
May 18, 2013.

Mathematical circles or clubs may have the goal of getting students to do well in mathematical competitions.

We are mostly interested in student's enrichment at the Fullerton Mathematical Circle. There is a continuous feedback process and we listen to students' suggestions. We have organized so far four sessions when the students were the speakers.

A sample Session when the students have been the speakers.

May 11, 2013

- Nikolay Grantcharov (M.L. King High School, Riverside) - Selected Theorems in Triangle Geometry. Based on *Geometry Revisited*, by Coxeter and Greitzer.

- Edward Zeng (First Avenue Middle School, Arcadia) - Problems from *Crux Mathematicorum*

- Christina Tran (undergraduate student, CSUF) - Geometry Problems in Putnam Competition

- Bryan Brzycki (Troy High School and CSUF) - Selected Problems from the 2013 USAMO

- Melissa Riddle (undergraduate student, CSUF) - Selected Problems from the 2012 W. L. Putnam Competition

- Lucy Odom (undergraduate student, CSUF) - What is Undergraduate Research?

Edward Zeng presenting solutions to problems from *Crux Mathematicorum*, May 11, 2013. Fullerton Mathematical Circle.
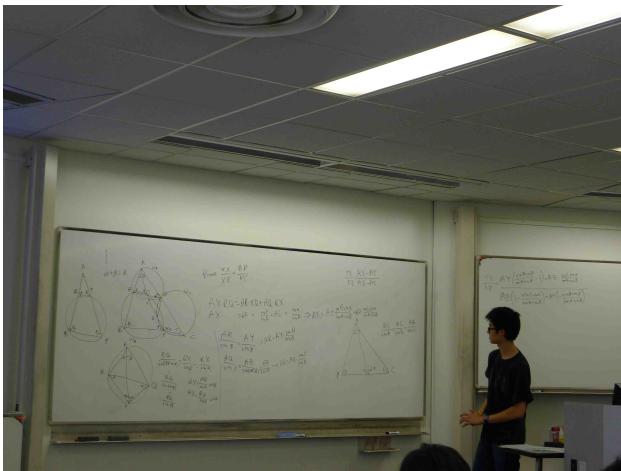
Bryan Brzycki presenting one of his solutions to a problem from the USA Math Olympiad, May 11, 2013. Fullerton Mathematical Circle.
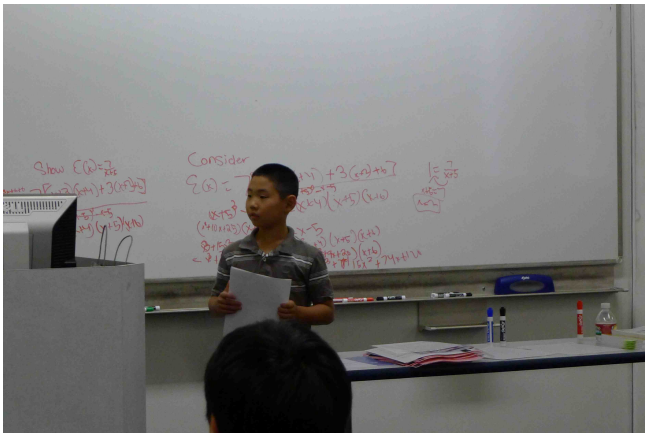
Kyle Kishimoto presenting one of his solutions to a problem from
Gazeta matematică, August 24, 2012. Fullerton Mathematical
Circle. Kyle submitted six solutions to *Gazeta* problems in the
academic year 2011-2012.

We focus the rest of our presentation on problems used in our Sessions for grades 2-4.

Problems from *Gazeta matematică*:

S:P12.346 We have a bag of candy. If we distribute them evenly among 4 children, then in the bag there are 3 candies left in the bag. If we distribute them evenly among 7 children, then in the bag there are 6 pieces of candy left in the bag. Can the bag contain 55 pieces of candy? Justify.

S:P12.350 In a basket there are three times as many apples than pears. The four people around the dinner table each eat an apple and a pear. In the basket there remains four times more apples than pears. How many apples and how many pears were in the basket at the beginning?

S:P12.357 Consider the exercise:

$$2 \times 3 \times 3 : 3 + 3 \times 3.$$

Place the parantheses accordingly so that you obtain:
(a) 9;
(b) 24;
(c) 72.
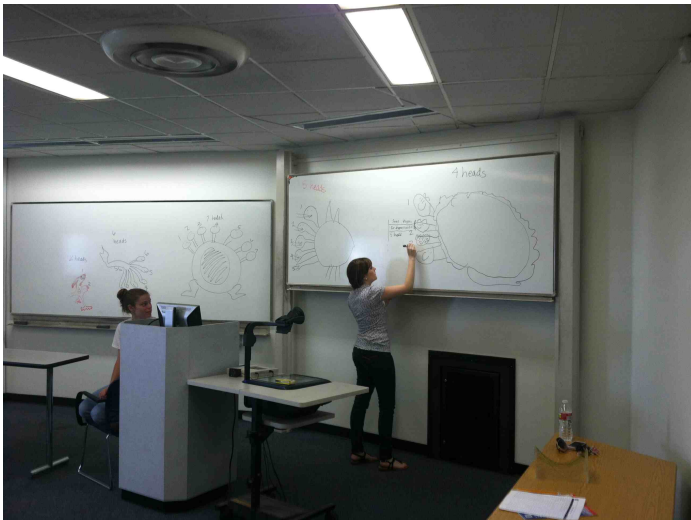
Rebecca Etnyre discussing a problem from Abacus International
Challenge in the Grades 2-4 Session, Fullerton Mathematical Circle.

S:P12.352 By increasing a number 10 times, we obtain the same result as when we add 108 to the same number. Find the number.

P:532 A number A is increased by 12 and we obtain the triple of another number B. Find the two numbers knowing that the difference between A and B is 40.

S:P12.181 My grandfather was born in the fourth year from the second decade of the last century. What age did he turn in the year 2000?

S:P12.194 A locker with code has the cypher formed of 5 digits. How many lockers with different cyphers can be made?

S:P12.207 In a candy store there are 248 chocolate figures. Half of the total number are chocolate stars, a quarter are chocolate bears and the rest of them are chocolate bells. How many chocolate bells are in the store?

What do our students learn from these problems?

- Explorations based on discussion on cases

- An introduction to combinatorial proofs

- Operations with measures like distance and time

- Advanced number sense

- First representations of story problems as mathematical models

What do we learn from these problems?

• As undergraduate students, for some of us the Math Circle sessions are among our first experiences as teachers

• We are seeing at work extremely gifted students

• We develop our teaching skills and we learn how to present to an audience that looks forward to be challenged by interesting problems

• We understand that education of gifted students is a subject of interest in mathematical education

Additionally, our Fullerton Mathematical Circle sends the solutions our students write to the editors. The solutions are acknowledged by the editors in *Gazeta matematică* and our students are recognized with diplomas once a year for Excellence in Problem Solving.

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We also host awards ceremonies to recognize our students achievements in American Mathematical Competitions and Math Kangaroo.