Riverbend Community Math Center

Newsletter

Summer 2009

From the Executive Director

Welcome to the inaugural issue of the Riverbend Community Math Center Newsletter! Since our formation in the summer of 2006, we have been working to identify the math-related needs of our community and to develop programs that meet those needs. The spring semester of 2009 has been an especially exciting time.

Our staff has expanded to include a technology specialist, a math education specialist, a great group of tutors, and an administrative assistant. With their help, we have been able to offer new activities during our weekly Math and Technology Academy and Family Math programs.

During the past year, the Notre Dame Office of Community Relations has kindly allowed us to offer programs for the public in their community building in downtown South Bend. Our Family Math sessions explored many subjects this semester including: modular arithmetic, alien math, π, isodot drawings (see figure), math games, and

An Isodot Drawing

our "Build it" festival (see photo). These activities enabled families to have fun together while learning about many different math topics.
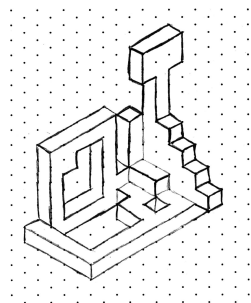
This semester, our Math Circle topic was Mathematical Origami. We folded paper tessellations, wove modular origami baskets, built 3-D Volkswagen cars from grid paper, wet-folded bats, and learned how to use origami axioms to trisect arbitrary angles. We also discussed how techniques such as creating new bases, grafting, point-splitting, and circle packing have extended the creative reach of folders and revolutionized origami as an art form.

We continued to work with teachers and staff in several school districts. Our growing collaboration with the South Bend Community School Corporation has resulted in exciting new initiatives this semester. With administrators, curriculum leaders, and teachers, we identified ways to strengthen math instruction at many Title 1 primary centers in South Bend. We helped the school corporation create a new Balanced Math program that complements their existing Balanced Literacy program. We provided training sessions for both math and literacy curriculum leaders on pedagogical techniques and conceptual understanding of elementary mathematics topics. We observed classes and gave presentations at Coquillard, Harrison, Lincoln, Madison, Monroe, Muessel, Perley, and Wilson Primary Centers in addition to offering professional development sessions for teachers at these and other schools.

Family Math: "Build it" Festival

As part of Perley Primary Center's After School Adventure program, we led a weekly Origami Class. We held weekly "Math Studio" sessions at the Sample Street Boys and Girls Club. Many of these sessions featured activities relating to fractions. We sponsored a Science Night station at the Montessori Christian School in Elkhart and taught parents and children to fold Magic Pinwheels and Sonobe Polyhedra. Lisa Nyers at St. Pius X Catholic School invited us to present a talk about Chladni Patterns and Sophie Germain to her 3rd grade science classes as part of their unit on sound. We also assisted with judging their Science Fair.

The South Bend Apprentice Academy asked us to teach a Geometry and Trigonometry Class to help

displaced workers learn additional skills that are in demand at local precision manufacturing shops. We also taught a GED Class for the Adult Education Department of the South Bend Community School Corporation.

We have continued to be active in local, regional, and national organizations promoting math and science education. In January, we attended the Joint Math Meetings in Washington D.C. We co-organized research presentations for the Summer Program for Women in Mathematics annual reunion. During the Joint Meetings we also participated in the formation of the SIGMAA on Circles – a national organization whose purpose is to facilitate networking among Math Circles and Teacher Circles around the country.

In February, we presented a session on mathematical origami and a math and plumbing module at the HASTI (Hoosier Association of Science Teachers Incorporated) conference in Indianapolis. The following weekend, we presented a "Quilt Fractions" activity at St. Joseph County Public Library's annual Science Alive event. We helped with the regional Indiana Science Olympiad at Goshen College where Jr. High and High School students were challenged to design an experiment to investigate the expansive potential of popcorn.

In April, we co-organized a Great Circles Conference (on Math Circles) at the Mathematical Sciences Research Institute in Berkeley, California. Mathematicians and teachers from around the United States and Canada met for two days to network and share ideas for leading math outreach activities for children and teachers.

Also in April was our community's second annual Next Steps in Math and Science Education conference. This conference, which we helped to plan as members of NISMEC (Northern Indiana Science, Math, and Engineering Collaborative), brought together approximately 100 educators, business owners, parents, professors, government officials, administrators, and community leaders to discuss strategies for improving STEM education. Bertha Carson-King gave the keynote address, and a panel of business, community, and education leaders provided context for this issue. Breakout sessions allowed participants to network and brainstorm next steps for improving math and science education in our community.

This summer we are looking forward to many exciting events. In June, we are collaborating with Ivy Tech to provide a two-week workshop for math teachers from each of South Bend's ten intermediate centers. We are also offering several Family Math sessions, including two that will launch a new Math Trail in downtown South Bend created by our math education specialist, Kat.

In July, we are co-organizing a week-long Math Circle Institute for mathematicians and teachers from around the country who are interested in leading math enrichment programs. Local educators are welcome to join us, and local students of all ages may participate in free Math Circle classes each afternoon.

During the last three weeks of July, students of all ages may join our Summer Math and Technology Academy. Students may choose to work on their math skills, pursue an independent math project, try our fun math and technology activities, or do a little of everything.

In August, my husband Dean and I will attend Math Fest in Portland, Oregon to meet with Math Circle leaders from around the country and to participate in a session on what math departments can do to promote math education in their communities. When we return, we will resume work with South Bend Community School Corporation to launch two new initiatives in eight Title 1 primary centers.

We hope to see many of you at our events this summer!

Amanda Katharine Serenevy, Ph.D.

Math and Technology Fair

Our spring Math and Technology Fair was a great success. Students presented their semester accomplishments, and, of course, we ate lots of pizza.

Discussing a Project

We encourage students in our Math and Technology Academy to choose projects at the start of each semester and work on them over at least several weeks. During this time, the students become experts in their topic, which is reflected in the stellar presentations that are shared each semester. Congratulations to all participants!

Diego presented a digital electronic calculator he built from a breadboard, LEDs, integrated circuit logic gates, and wires. His machine can add two binary numbers. Eleanor taught the younger students about solving algebraic equations. She will be joining us as one of our junior tutors for our Summer Math and Technology Academy. Fiona explained an algorithm for solving a Rubik's cube. She demonstrated this procedure during her talk by solving the cube on the spot. Kim had everyone chuckling at her math jokes. "There are three people in a room and seven of them walk out. How many people must enter the room to make it empty?" Victoria presented a medieval math game called Glückhaus. She taught several people to play this interesting strategy game.
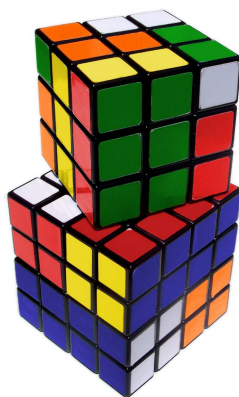
Jimmy, who is 5 years old, made a poster about playing the Uno card game. Natsu made a colorful poster about fractions. Valeria built a unique model "tree house" out of Polydron pieces and then learned to use the computer program Xfig to diagram different views of her design. Yume made a poster about how to multiply by 10s.

Rubik's Cube

A Hungarian professor named Ernö Rubik invented the Rubik's cube in the 1970s. He invented it to give his students more hands on experience with three-dimensional objects. Many of us have struggled to solve a Rubik's cube puzzle since they became widely available in the 1980s. In the past, some of us have even resorted to moving the stickers in order to solve one.

Since Fiona started her project in January, Rubik's Cube solving has become all the rage among parents, tutors, and students during Math and Technology Academy and Family Math events.

There are exactly $43,252,003,274,489,856,000$ (approximately 43 quintillion or 4.3×10^{19}) distinct con-

figurations of the standard Rubik's cube. However, every one of those configurations can be solved using 22 moves or fewer! Coming up with a perfectly optimized solution requires some heavy computing power, so human solvers approach the problem differently. To solve a Rubik's cube it helps to find sequences of steps that perform an action while keeping as much of the rest of the cube unchanged as possible. For example, suppose you have your red/white/blue corner piece in the correct place, but it is oriented incorrectly so that the corner needs to turn counterclockwise (see figure).
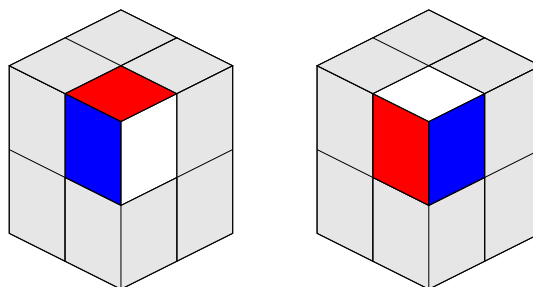
What you have ⟶ what you want

There are many sequences of steps that could accomplish this, but different sequences are shorter or longer and will affect other squares in the cube more or less. Finding and learning useful sequences of steps is an important part of successfully solving the Rubik's cube.

Some true facts about the $3 \times 3 \times 3$ cube:

- Any sequence of steps which turns one corner clockwise must turn another corner counterclockwise.
- Any sequence of steps which flips one edge must also flip another edge.
- Any sequence of steps which exchanges a pair of corners must also exchange a pair of edges (and vice versa).

New Staff Members

Ray, Kat, Diane, Gwinn, Mike, Peggy, Ray, Raul, and Cassie have joined Amanda to lead our Math and Technology Academy and Family Math programs. Each of them has a unique range of talents and outlook on math. This enables us to better serve students who come to us for help, to pursue an independent project, or to have fun playing with math. We would like to introduce each one so you can get to know us a little better.

Ray, our technology specialist, joined us in the spring of 2008 to co-sponsor a Math Circle on fractals and has been with us ever since. Ray is proud to be "a geek and a nerd." He loves Jazz and working with kids. He substitute teaches in the South Bend Community Schools and has a work history with electronics and computers. During Math and Technology Academy, he can usually be found in the computer lab. He especially enjoys mentoring students who want to learn basic electronics or computer programming.

Some of our Staff Members
Peggy, Gwinn, Diane, Ray, Cassie, Mike, Amanda

Kat (who is not in the photo) has joined our staff as a math education specialist. Kat taught middle school in Arizona before becoming a teacher in residence at the University of Arizona Institute for Mathematics and Education. Many of us have had the chance to meet her new baby, Sarah, during origami class and family math events. Kat organized our Build-it Festival in February and is currently creating Math Trails in downtown South Bend with the help of Family Math participants. She has also led workshops for primary and middle school teachers in our area.

Diane loves geometry and has served as a substitute teacher in John Glenn Schools. She has returned to school, after raising her family, to become a teacher. Diane is working on an elementary education degree at Indiana University South Bend. Diane loves to work with our youngest visitors during Math and Technology Academy and Family Math events.

Gwinn is finishing her Masters degree in Post Secondary Adult Education this June. She says she likes developmental algebra: arithmetic to college level. Gwinn also says she "enjoys working particularly with adults because they are motivated and that makes teaching fun." Gwinn usually works with adults who need to brush up on math skills, prepare for a test, or who need help with a math class.

Mike works for South Bend Community School Corporation as a primary center math curriculum leader.

Mike's daughter, Tori, often joins us for Math and Technology Academy and Family Math activities. Mike likes "studying all aspects of math." He is particularly fond of math history and can add, subtract and multiply Roman numerals with the method used during the time of Nero!

Peggy has a BA degree in math and has worked as a computer programmer for many years. She has recently become a substitute math teacher for South Bend Community School Corporation. She says she really loves Algebra and enjoys "inspiring students to love math and not fear it." She has three grown sons, all of whom she helped with their math homework. Peggy has the experience to work with all age groups and to share her love of math.

Raul (who is also not in the photo) is a math education student at Indiana University South Bend. He is studying to become a high school math teacher. Raul serves as a tutor for our older students who need help with algebra, geometry, trigonometry, calculus, or more advanced classes. Although Raul will not be able to join us during the Summer Math and Technology Academy, he will be with us again in the fall.

Cassie, our administrative assistant, is usually the first person you see during Family Math or Math and Technology Academy events. She answers the door and keeps track of sign-in sheets and daily logs. As Amanda's sister, she is uniquely qualified to keep Amanda organized and make things work smoothly during Riverbend Community Math Center events.

Our photo is also missing Caroline, who regularly helped students this past semester with algebra, biology, and chemistry. Caroline is moving on to graduate school in Biology starting this summer. Congratulations, Caroline!

Upcoming Events

All of the events listed below are free and open to the public. Some events require pre-registration. Find registration forms and more details on our web page (http://riverbendmath.org/) or by contacting Amanda (amanda@riverbendmath.org; 574-339-9111).

Family Math
2 - 3 pm at 217 S. Michigan Street
June: 7, 14, 28

Math and Technology Academy Open House
at 217 S. Michigan Street
June: 2, 4, 7, 9, 11, 14, 16, 18, 28

Summer Math and Technology Academy
6 – 8 pm, Registration required
July: 13, 14, 15, 16,
      20, 21, 22, 23,
      27, 28, 29, 30

**Math Circle Institute**
July 6 – 10, 3:15 – 4:30pm
Notre Dame Campus

Students in 1st through 12th grade have the opportunity to attend a week of Math Circle classes at Notre Dame. Students will work with mathematicians and teachers from around the country.

Register by June 27th.

Puzzler
Pong Hau K'i

Pong Hau K'i is an ancient Chinese game. It is also played in Korea under the name "Ou-moul-ko-no." Each player has two playing pieces (use coins, pebbles, or anything else) that are initially placed on the game board as shown. Players take turns moving one of their pieces along a line to an adjacent empty dot. Jumping over another piece is not allowed. The object of the game is to trap the opponent's pieces so that they cannot make any moves.
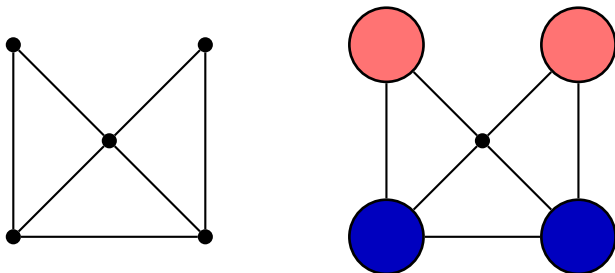
An empty game board,
and one in the starting configuration

Play this game with your friends to answer these questions.

- Is one set of pieces better than the other?
- How many possible configurations are there?
- What are the best strategies for the players?
- Can you force a win in a game?
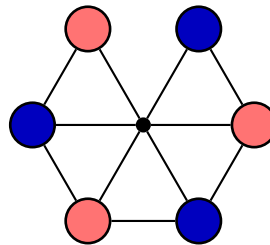
Also try this hexagonal variant or make up your own!

Source: *Ivan Moscovich's Mastermind Collection: Leonardo's Mirror & Other Puzzles*, Sterling Publishing Co., Inc., 2004

Private Tutors

The Math Center maintains a list of individuals interested in providing private tutoring on its webpage (http://riverbendmath.org/tutoring/private_tutors). If you are looking for a private tutor, be sure to check this list. If you or someone you know would like to appear in this listing, send an email to dean@riverbendmath.org.
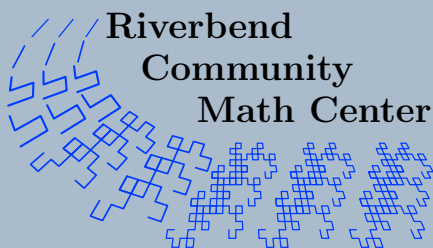
Contributions

The Riverbend Community Math Center is a publicly supported not-for-profit organization. We appreciate any donations of cash, goods or services you are able to provide. If you have questions or would like to donate services or materials, feel free to contact Amanda Serenevy at (574) 339−9111.

Thank you for fostering enthusiasm for mathematics in our community!

Please make your check payable to:

    Riverbend Community Math Center
    1021 Queensboro
    Mishawaka, IN 46544

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