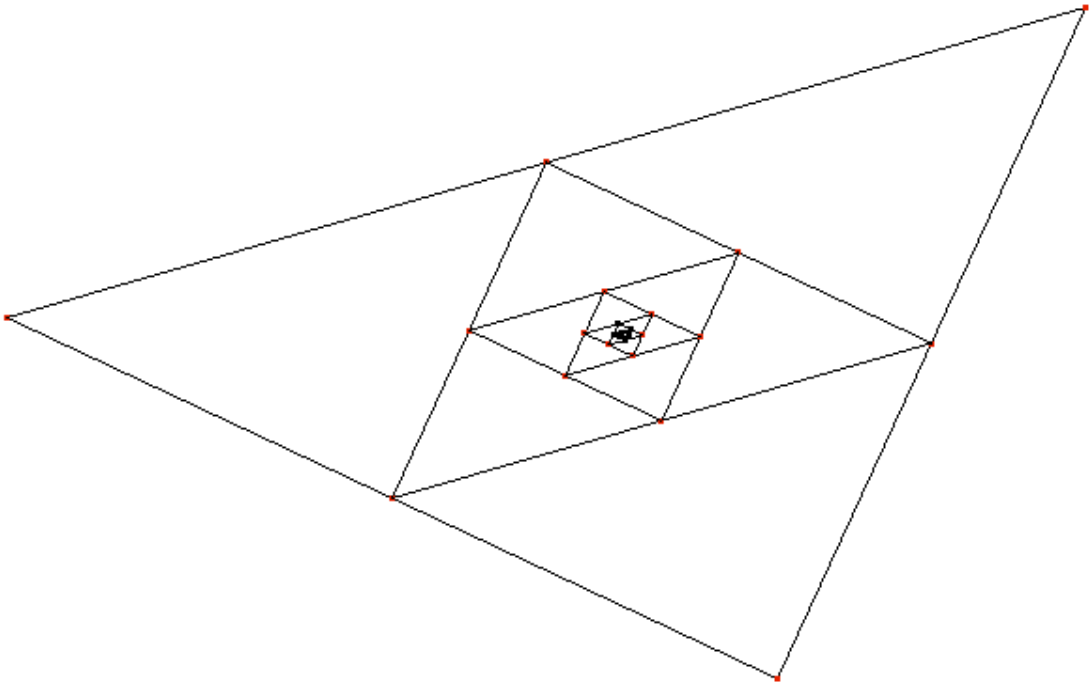
The Centroid



In This Issue:

Official Journal of the North Carolina Council of Teachers of Mathematics
Volume 32 • Number 2 • Fall 2006

The Centroid is the official journal of the North Carolina Council of Teachers of Mathematics (NCCTM). Its aim is to provide information and ideas for teachers of mathematics—pre-kindergarten through teacher education. *The Centroid* is published in January and August. Subscribe by joining NCCTM; see the Membership Form on the last page.

Submission of Manuscripts

We invite the submission of news, announcements, and articles useful to school mathematics teachers or mathematics teacher educators. In particular, K-12 teachers are encouraged to submit articles describing teaching mathematical content in innovative ways. To be considered for inclusion in an issue, news and announcements must be received by November 1 for the spring issue and by June 1 for the fall issue.

Manuscripts that have not been published before and are not under review elsewhere may be submitted at any time to the address below. Submit one electronic copy via e-mail attachment (preferred) or diskette in *Microsoft Word* or rich text file format. To allow for blind review, the author's name and contact information should appear *only* on a separate title page. Manuscripts should not exceed 10 pages double-spaced with one-inch margins. Figures and other pictures should be included in the document in line with the text (not as floating objects). Scannable photos are acceptable and should be large glossy prints mailed to the editor or minimum 300 dpi tiff files emailed to the editor. Proof of the photographer's permission is required. For photos of students, parent or guardian permission is required.

Manuscripts should follow APA style guidelines from the fifth edition of the *Publication Manual of the American Psychological Association* (2001). References should be listed at the end of the article, and should also follow APA style, e.g.,

Bruner, J. S. (1977). *The process of education* (2nd ed.). Cambridge, MA: Harvard University Press.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

North Carolina Department of Public Instruction. (1999). *North Carolina standard course of study: Mathematics, Grade 3* [On-line]. Available: http://www.ncpublicschools.org/curriculum/mathematics/grade_3.html

Perry, B. K. (2000). Patterns for giving change and using mental mathematics. *Teaching Children Mathematics*, *7*, 196–199.

Ron, P. (1998). My family taught me this way. In L. J. Morrow & M. J. Kenney (Eds.), *The teaching and learning of algorithms in school mathematics: 1998 yearbook* (pp. 115–119). Reston, VA: National Council of Teachers of Mathematics.

General articles are welcome, as are the following special categories of articles:

- *A Teacher's Story*,
- *History Corner*,
- *Teaching with Technology,*
- *It's Elementary!*
- *Math in the Middle*, and
- *Algebra for Everyone*.

Editorial Board

About the Cover

The Centroid logo is based on the following theorem: The limit of the sequence of midtriangles of a triangle is the centroid of the triangle.

Copyright

Contact Information

Address all correspondence and submissions to

The Centroid
c/o Dr. Holly Hirst, Editor
Department of Mathematical Sciences
121 Bodenheimer Drive
Appalachian State University
Boone NC 28608-2092

or send email to <HirstHP@appstate.edu>. Please include a return email address with all correspondence.

The Centroid

OFFICIAL JOURNAL OF THE NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS
VOLUME 32 • NUMBER 2 • FALL 2006

Articles

News & Information

From the Editor

More Change for NCCTM

Holly Hirst
Appalachian State University
Boone, North Carolina

Another summer is over, and school has begun. Brian and I are glad to have another Centroid finished and in your hands. This has been an eventful year for NCCTM. The most noticeable change for the members is the website <www.ncctm.org>. More of the forms and applications are available on line; be sure to check the site often for information.

This year has brought sad news as well; following the loss last November of founding member Bill Palmer, we are saddened by the death of founding member Katye Sowell. She worked long and hard to make NCCTM a success. She will be missed.

We hope you enjoy this issue. The articles on the birthday project and the penny project contain ideas that can be adapted to almost any grade level.

As always, we encourage you to consider assisting with *The Centroid* by:

- **submitting a manuscript** – general articles are welcome, as are the following special categories of articles: *A Teacher's Story*, *History Corner*, *Teaching with Technology, It's Elementary!*, *Math in the Middle*, and *Algebra for Everyone*.
- **becoming a reviewer** – please send e-mail to me if you are interested in helping in this way.

Contact information. Feel free to contact us at any time with submissions, news items, questions, or concerns.

Holly Hirst <HirstHP@appstate.edu>
Brian Felkel <FelkelBH@appstate.edu>
Department of Mathematical Sciences
Appalachian State University
Boone, NC 28608
828-262-3050
http://www.mathsci.appstate.edu/centroid/

In Memoriam
Dr. Katye Sowell

We were saddened to hear of the loss in May of another founding member of NCCTM: Dr. Katye Sowell, first president of the Eastern region and third president of NCCTM. A Professor of Mathematics Education at East Carolina University until recently, Dr. Sowell grew up in Reidsville, graduated from Flora McDonald College (now part of St. Andrews Presbyterian College), and received a Masters in Mathematics from the University of South Carolina. She taught at Elon College and the University of Southern Mississippi for several years before beginning work on a PhD in Mathematics Education at Florida State University.

Before NCCTM was established, there were two organizations for mathematics teachers in North Carolina, one for black teachers and one for white teachers. Dr. Sowell worked tirelessly with Josie Thompson, then president of the black teachers organization, to bring all math teachers together in the newly formed NCCTM. Arm-in-arm they provided leadership and friendship as an example to all of what this new organization could be.

John Kolb, current Trust Fund Chair, recalls the very first Eastern region meeting at which Dr. Sowell and Ms. Thompson presided over the general meeting of more than 400 math teachers: "Around the walls of that auditorium was a sign for each county contained in the Eastern region. Katye would call out a county, 'Jones County,' and some math teachers would stand up and cheer; 'Columbus County,' and teachers would stand up and cheer; 'Halifax County,' and teachers would stand up and cheer. You could just feel the pride. I thought: This organization is really going to make! I had never been to a meeting where there was so much enthusiasm and pride in the profession. That was Katye Sowell. She was all about math teachers, and she loved them all!"

Presidents' Messages

State President
Jeane Joyner

joynerj@meredith.edu

NCCTM is a volunteer organization, and this spring and summer NCCTM has really put our volunteers to work! There were math fairs to organize and judge, mathematics contests to host and students to coach, logos to select and t-shirts to order for the fall conference, a Centroid to publish, workshops and sessions to organize, and other conference details to attend to. As the organization grows, each of these tasks also becomes larger.

Special recognition needs to go to Bill Scott and Rebecca Hoover for countless hours they invested in working with CC Communications to get on-line functions in place. Without their dedication and willingness to devote time and talents far beyond what any of us anticipated as we moved into this venture, NCCTM would not have the on-line features and website updates that we will enjoy this fall.

You can now join or renew your membership on-line. We hope that each of you will also register for the fall conference via our website, <www.ncctm.org>. Later this fall you will be able to vote electronically for new officers; and early next year, you will be able to register for spring conferences. Meanwhile, other NCCTM members are working on special features for a Members Only section of our website. In the coming school year please plan to check the website frequently to watch for additional features.

Finally, I hope that you will plan to join me and other NCCTM Board members for the Plenary Session at the Fall Conference. This 36th Annual Conference is packed with professional development opportunities. The Thursday afternoon session that includes a brief business meeting affords you an opportunity to personally say thanks to your officers and other volunteers who make NCCTM one of the best professional organizations in the state!

Eastern Region President
Julie Kolb

jkolb@wcpss.net

Greetings to the members of the Eastern region. Once again the summer has flown by and we are anxious to begin a new school year. A summer of relaxation and renewal is essential to successfully meeting the challenges that we will face.

I hope that you were able to acquire the energy to begin another exciting year of teaching. Contrary to what many people think, beginning each school year is like our first year of teaching as we encounter challenging students and a changing curriculum.

I hope that you are making plans to continue your renewal process by attending the fall conference on October 5 and 6 at the Koury Convention in Greensboro. It's a great opportunity to meet with other professionals to gain new ideas and activities for the classroom! Remember that you will be able to view the preliminary program and register for the conference on-line! The website address is the same <www.ncctm.org>; however, many wonderful "upgrades" have taken place!

The 2006 Spring Conference at Meredith College in Raleigh was a wonderful experience. Thank you to everyone who played a part in creating and conducting such a wonderful staff development and networking opportunity. The Eastern Region Spring Conference for 2007 will be held on February 17 at Wesleyan College in Rocky Mount. Let's hope that the weather cooperates once again.

Please be reminded that we have a wonderful group of officers throughout the state, and we are very excited about all that we hope to accomplish. NCCTM board members for the Eastern Region are: Elementary Vice President: Carolann Wade; Middle Grades Vice President: Lucy Kay; Secondary Vice President: June Blackwell; College Vice President: Gail Stafford; Secretary: Elizabeth Murray.

We were all deeply saddened to hear of the death of an outstanding NCCTM leader, Dr. Katye Sowell. Dr. Sowell, professor emeritus at ECU and a founding member of NCCTM, was the first president of the Eastern Region and a past president of NCCTM. It was through her efforts that the membership of the eastern region grew tremendously in the early years of our organization. She provided a high standard of leadership for all to aspire to.

I hope that you will help me in sustaining the strength of our organization by continuing to be active participants and by providing me and the rest of the board with suggestions for activities

that will meet your professional needs. As members of NCCTM, we are fortunate to have many opportunities for professional interaction and development. Please enjoy the ideas presented in this issue of the *Centroid* and don't forget to make plans now to attend the fall NCCTM conference. You'll be glad you did.

Please contact me <jkolb@wcpss.net> with any suggestions that you have for improving our organization or ideas for professional growth activities and conference programs (perhaps you would like to make a presentation).

Make it a great school year!

Central Region President
Emogene Kernodle

nekernodle@yahoo.com

The Central Region would like to thank Vicky Moss for the outstanding leadership she has given NCCTM during the past four years most recently as Central Region Immediate Past President. In May, we welcomed Becky Caison as the Central Region President Elect. She has been most willing and helpful in doing the work of the board.

Vincent Snipes from Winston-Salem State University will complete the term of Cos Fi as Central Region Vice President for Colleges. Cos is at Michigan State University for this academic year. We are very fortunate to have Vincent join the board. We look forward to his expertise and enthusiasm.

Let's not let the outstanding work of Wendy Rich go without recognition and thanks in making the Central Region Math Fair a great celebration of learning. It was so exciting to see the young mathematicians and their projects. The only thing missing was secondary representation. There were no secondary projects!! Appreciation is extended to Greensboro College for their assistance in making the fair such a success.

And finally as NCCTM takes the next step to serve the membership with an improved website, please keep your membership information up to date. Earlier this year, I emailed the Central Region members about the joint Spring Regional Conference and more than 150 of the emails bounced. Many members didn't have an email address listed. With the cost of postage continuing to rise, email will be the method of communication. If you are in the Central Region and didn't get an email from me earlier this year or if you have changed schools and your email address has changed, please email me <nekernodle@yahoo.com> and I will pass the information to the correct people.

Western Region President
Carmen Wilson

cwilson@ashe.k12.nc.us

Welcome to a new school year! I trust that you savored the summer break and that you are now refreshed and eager to get back into the classroom.

Thanks to everyone who helped with the Western Region Math Fair and/or Western Region Spring Conference in 2006. The Western Region Spring Math Conference was held on February 18th at Appalachian State University on a beautiful snowy day. Over 200 pre-service and in-service teachers attended despite the inclement weather. The pre-service sessions were themed "Get Mountains of Help with Your First Year of Teaching." Participants took away lots of great ideas, door prizes and memorable math tunes, thanks to Asheboro's Adam Reeder. In-service teachers attended sessions to help them "Climb to the Top with the New Curriculum."

The Western Region Math Fair was held in the Plemmon's Student Union at Appalachian State University on April 1st. Participation in this event continues to grow. This year there were 216 projects by 276 students, who represented 65 different schools. First place in K-2 went to Celine Borthayre from Lake Norman Elementary School. First place in grades 3-5 was awarded to Jessica Fletcher from Lake Shore Elementary School. Casey Wallen and Kyle Robinson from Clyde A. Erwin Middle School won first place in grades 6-8 and Brandon Broome and Justin Huntley from Victory Christian Center School won first place in grades 9-12. Congratulations to these and all of the other winners and participants.

It is already time to plan the 2007 Western Region Spring Conference. Watch for more information to be coming out soon. If you would like to assist in the conference planning or at the site, please contact me <336-246-2400, cwilson@ashe.k12.nc.us>.

As you begin the new school year allow this organization help you in your classroom. NCCTM mini-grant applications are due by September 15th. The state conference is in Greensboro on October 5th & 6th. Plan now to attend and gather ideas and materials to enrich your teaching from your colleagues who will be sharing in the many sessions and workshops.

In parting, let me remind you that we desperately need more students in our nation to major in the areas of science, technology, engineering and mathematics. Now is your chance

to share your enthusiasm for mathematics with your students and inform them about some of the many career opportunities available in these areas. Be sure to remind them of this: "Do math and you can do anything!" Best wishes to you and your students in the year ahead.

NCCTM Trust Fund Scholarships

Thinking about going to graduate school in mathematics education? Already in graduate school? NCCTM offers scholarships to any NCCTM member who is currently employed as a K-12 teacher in North Carolina. The funds can be used to pay for coursework in mathematics or mathematics education. Recently took a class? It is not too late. The funds can be requested by members who have completed a course within the previous four months of the application deadline (March 1 and November 1). Interested? The application is on the last page of this issue!

The NCTM Mathematics Teacher is 100

Did you know the NCTM journal Mathematics Teacher (MT) is celebrating 100 years of continuous publication? NCTM has planned many events and activities to celebrate the MT's 100th anniversary, including:

- An anniversary issue in January containing a collection of notable articles from the past. MT subscribers will receive this commemorative issue free with their membership.
- President's Choice in each MT issue during the volume year. Past presidents of NCTM choose their favorite articles and explain what makes them so.
- A commemorative poster of readers' 100 favorite Calendar Problems from past years. MT subscribers will receive the poster free with their membership.
- An opportunity to build a large Pascal's Pyramid out of Legos or ZomeTools at one of our 2006 Regional Conferences.
- A collection of problems and resources on Pascal's Triangle and Pascal's Pyramid, for use with students from the upper elementary grades onward. The collection will be available this fall online and at conferences.
- An Anniversary Celebration in Atlanta. Help us build Pascal's Pyramid, attend special anniversary sessions, and celebrate our birthday!

Learn more about the yearlong celebration by going to the NCTM website.

<www.nctm.org/publications/mt100.htm>.

Mathematicians, Birthdays, Calendars, and a Student Project

Dan Schellenberg[1]
Greenall School
Balgonie, Saskatchewan
Bill Bauldry[2]
Appalachian State University
Boone, North Carolina

There are many good reasons to bring the history of mathematics into the classroom: bringing a human dimension to the subject, giving a perspective of development, tying diverse knowledge areas together, etc. An engaging little activity that has been successful in our high school and college classrooms is the *Mathematician's Birthday Project*. Students look for a mathematician with the same birthday as theirs. Younger students can simply report on the names and number of mathematicians sharing their special day. Older students can write a brief note about their chosen mathematician's life. Advanced students can produce a research paper on the mathematicians, their lives, and how their work is important in mathematics. The project combines many facets and helps to bring math alive. Diverse areas from history to writing to library research are combined in an activity that has a personal touch.

We have put together a calendar that includes over 1,300 mathematicians' birthdays with URLs linking to biographies at the MacTutor History of Mathematics archive at the University of Saint Andrews in Scotland. The archive's main web address is

http://www-history.mcs.st-and.ac.uk/history/.

The birthday calendar is available for Apple's *iCal* at

http://www.icalshare.com/article.php?story=20050428051303805.

This format is compatible with many calendar programs. To see a calendar showing the birthdays, visit the website

http://www.mathsci.appstate.edu/~wmcb/Class/phpcalendar/week.php?cpath=&getdate=20060801&cal%5B%5D=MathematicianBirthdays.

Below is a sample of the project handout that we have used in high school and college calculus.

Mathematician Project

List your birthday: _____

Find a mathematician born on the same day as you. Write a description (≤ 1 page) of the work your mathematician is known for; add a picture if possible. Your target audience is a calculus classmate. For extra credit: Choose a mathematician from an under-represented group.

[1] *In addition to teaching senior math and computer science, Mr. Schellenberg coaches volleyball and is very interested in authentic instruction through problem-based learning.*

[2] *Former department chair of mathematical sciences, Dr. Bauldry has returned to teaching mathematics full time and is very interested in the use of technology in collegiate mathematics.*

A Penny's Worth of Principles and Standards Using Scientific Notation

John Staley [1]
Hereford High School
Randallstown, Maryland
Patricia S. Moyer[2]
George Mason University
Fairfax, Virginia
Donna R. Sterling[3]
George Mason University
Fairfax, Virginia

A Penny For Your Problem

"How much is a penny worth? Have you ever thrown away a penny? If you had enough pennies to fill your bedroom, how much money would you have?" These were just a few of the questions that were asked as a high school Algebra I class completed the study of exponents and scientific notation. The teacher was in search of real life applications of scientific notation, something students could put their fingers on, to get a feel for the mathematics. What evolved was a three-day lesson entitled *Pennies, Pennies, Everywhere!!!* (Staley & Walls, 1999). During this multimedia interdisciplinary lesson students utilized ratios, proportions, measurement and conversion skills, perimeter, area, volume, and scientific notation to determine the value of penny-filled cubes the size of their desks, the classroom, the earth and other celestial objects. The initial purpose of the lesson was to determine the amount of money that could be contained in a classroom full of pennies. This had direct relevance to the students, because each week the school held a penny collection to raise funds for a charitable cause.

The Principles and Standards in Action

The lesson *Pennies, Pennies, Everywhere!!!* directly incorporates the NCTM Principles (Equity, Teaching, Learning, Assessment, and Technology), the Content Standards (Number & Operations, Algebra, Geometry, Measurement, and Problem Solving), and the Process Standards (Communications and Connections) (NCTM, 2000). This article discusses how the Principles and Standards played an integral role in the design and implementation of the lesson in an Algebra I high school class.

Lesson Overview

This three-day lesson consists of several classroom activities and an assessment in which students work collaboratively to complete a variety of tasks involving the number of pennies that can fit into different objects. They calculate the penny value for perimeter, area, and volume of various objects. Day one's activities: *Sizing Things Up* uses a brief video clip to review ratios and proportions, and *Penny Statistics* allows students to gather measurements on pennies, a desk and the classroom. The second day's activity, *To Infinity and Beyond…*, utilizes the Internet to gather data about celestial objects that

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[1] John Staley is Coordinator of Secondary Mathematicsfor Baltimore County Public Schools and is a former secondary mathematics teacher.
[2] Patricia S. Moyer is the Director of the Mathematics Education Center and Coordinator and Associate Professor of the Mathematics Education Leadership programs at George Mason University, where her research interests focus on uses of representations in mathematics teaching and learning.
[3] Donna Sterling is Director of the CREST Center and Coordinator and Professor of the Science Education Leadership programs at George Mason University.

are compared to the size of the classroom. Day three's activity is the assessment that involves students in determining the penny value of a football field and writing a letter explaining the process used to calculate the penny value of their bedrooms.

We use the following vocabulary for penny measurements.

- Penny Statistic - the conversion of an object's length, width or height into a quantity of pennies.
- Penny Width ($penny_w$) - the diameter of one penny, it is used for length and width measurement conversions. 1 $penny_w$ = .75 inches or 1.33 $penny_w$ = 1 inch. Area calculations use squares the width of one $penny_w$.
- Penny Height ($penny_h$) - the thickness of a penny is used to measure height. 1 $penny_h$ = .10 inch or 10 $penny_h$ = 1 inch. Note $penny_h$ is used to convert the height of an object into its penny statistic.
- Penny Value - the dollar worth of an object after its length, width or height has been converted into penny statistics.

We assume that all pennies are neatly placed in rows and columns when being counted for area and perimeter.

Videos Captivate Students

To begin the first activity, we showed *Sizing Things Up*, an episode from the Numbers Alive! TV series produced by Maryland Public Television (1995). This episode documents a rock band's adventures while performing at Camden Yards, where the band members use ratios and proportions to make a variety of estimations.

The *Sizing Things Up* activity sheet following this article focuses students on the following tasks: recording the capacity of Camden yards; calculating the number of stadiums, the same size as Camden Yards, that it would take to seat one million people; and determining the amount of money a hot dog vendor would donate to a charity.

As the class viewed the video segments, students actively participated in the discussion while completing the worksheet. Pausing the video allowed ample opportunity for students to record information, perform calculations, and share their answers with classmates. More importantly, it allowed the teacher to check student readiness for the lesson by assessing prerequisite skills of number computations, ratios, and proportions. The teacher used the following series of questions for this purpose after the first two video segments.

(1) How many people can Camden Yards seat?
(2) How might you determine the capacity of the stadium?
(3) Do you think this is an accurate way to estimate the seating capacity for the stadium?
(4) How many stadiums of this size would you need to seat one million people?

During the discussion about the number of fans that could fit into Camden Yards, several students began to see the connection with the teacher's question from before the start of the lesson: How many pennies do you think it would take to fill a box the size of your desk or the classroom? They used this connection along with their understanding of ratios and proportions when making estimations.

After video segment 3 in which ratios and estimates are used to help the owner of the concession stand, the teacher asked:

(1) How much money will Ben, the owner of the concession stand, donate for each hot dog sold at the game?
(2) What is the ratio of hot dogs sold to people in attendance?
(3) If the stadium holds approximately 50,000 people, how many hot dogs will Ben sell?
(4) How much money will he donate?

After viewing the video, the class quickly transitioned into *Penny Statistics*—the second activity sheet at the end of this article—where students gathered various measurements related to pennies, their desk, and the classroom. Students applied the Measurement Standards, including understanding measurable attributes of objects and the units, systems, and processes of measurement, and applying appropriate techniques, tools, and formulas to determine measurements, to complete the activities (NCTM, 2000). They used materials from their packets: a standard ruler, 5 yards of string knotted at yard intervals, a yardstick, and a handful of pennies. The teacher began the lesson by defining a penny height as the thickness of one penny used to measure height and the penny value as the dollar worth of an object after its length, width or height have been converted into penny statistics and the perimeter, area or volume calculated. A student then read the directions aloud and the teacher stated that the first goal was to gather all measurements before beginning the calculations.

The collaborative groups of four students began their adventure of gathering measurements

of pennies, stacks of pennies, desks, and the classroom as the teacher circulated around the classroom observing their progress. Students first estimated the number of pennies in a one-inch stack, the number of pennies needed to cover their desks, and the number of pennies in a stack that would reach from the floor to the ceiling of the classroom. Next they measured the diameter of a penny, the thickness of a penny and the number of pennies in a one-inch stack.

Students measuring a one-inch stack of pennies.

After completing all of the measurements, students used ratios and proportions to determine the number of pennies in a one-foot stack, a one-yard stack, and a yard of pennies lying flat on a table. Students then measured their desk and the classroom in inches and converted these measurements into the appropriate penny equivalent before calculating perimeter, area, volume, and determining the penny value of each object.

Student work during each part of the lesson was monitored with the use of built in checks on the worksheets that required the teacher's initials before proceeding to the next section. For example, when students completed Part B of the *Penny Statistics* worksheet, they obtained the teacher's initials then proceeded to measure their desks. A second check required students to get the teacher's initials before gathering classroom measurements. Students of varying ability levels and grades (9^{th}-11th) were very involved in the activity. Students discussed different strategies to complete the various measurements and utilized different tools at their disposal to gather measurements. Most of the groups were able to gather the measurements without any assistance from the teacher.

Interdisciplinary Activities Enrich the Lesson

On the second day, students completed the *To Infinity and Beyond…* activity, which involves research on the Internet and extensive use of scientific notation to perform various calculations. Students used the first 15 minutes of class to gather and record the diameter of several celestial objects from pre-selected Internet sites. For many of the students this activity incorporated material they had studied in their science class, and it applied scientific notation skills recently studied in mathematics class. Once they completed gathering and recording the data they began a series of calculations that allowed them to compare the size of their classroom with an earth-sized cube and other cubes the size of celestial objects.

Students first converted the room volume from the previous activity, Penny Statistics, from cubic inches to cubic kilometers, using their ratio and proportion skills. Next students determined the volume of a cube with sides the length of the earth's diameter, approximately 12756.3 km. They also determined the number of classrooms that could fit inside of an earth cube, which they labeled N = volume earth cube / volume of classroom.

During the remainder of the class students calculated the volumes of cubes with sides equal to the diameters of the following celestial objects: Venus, Mars, Jupiter, Saturn, Neptune, and Pluto. They compared each volume to the size of the earth cube and determined the number of classrooms that could fit inside. Their last calculation involved determining the penny value for each object. This allowed students to compare the various objects in the context of dollars and cents, which gave them a referent for understanding the magnitude of the different sizes of each object.

Alternative Assessment Leads to Community Involvement

The assessment activity consisted of two parts, completing a written assessment modeled after the Maryland assessment test and making fliers or brochures. Students first calculated the number of pennies needed to cover a football field. Students then wrote a letter to a friend explaining the process used to determine the number of pennies needed to fill their bedrooms. This writing activity provided opportunities for students to practice the necessary writing skills while communicating about mathematical concepts. The use of familiar test formats, in our

case the Maryland mathematics assessment, allowed for review and reinforcement of test taking skills, incorporated writing into the mathematics curriculum, and served as a summative assessment for the lesson.

The enduring understanding students gained from the lessons about penny measurements and planets was revealed several days later when students created and presented a flier for the school's penny collection program. The flier had to be informational (the dates, times of penny collection and general purpose) and educational (information learned during the lesson). The use of technology was not required but highly recommended, and several students used a desk top publishing tool to create their projects. One student created a tri-fold brochure stating several facts about pennies and the information about the penny collection day. Another student's flier compared the weight of an F-16 jet to the jet's penny value. Many of the projects were displayed in classes throughout the school to promote penny collection day.

Pennies Add Up

As we reflected on the development of the lesson and how it was implemented we focused on two Process Standards: Communications and Connections (NCTM, 2000). The contextual nature of the lesson allowed students to make connections between mathematics and science content, enabling them to recognize and connect among mathematical ideas, and apply mathematics in contexts outside of school mathematics (NCTM, 2000). A major benefit of the lesson context was that it gave students a purpose for performing various calculations that connected to the school's fund raising activity. Students were no longer just doing the mathematics for the purpose of practice but they were highly engaged in trying to determine the amount of money that could be contained in each object.

Students were initially engaged out of curiosity for the number of pennies needed to fill the classroom, which led to their motivation for conducting the various measurements and calculations. The use of celestial objects was a direct connection to material they had recently studied in their science class. This allowed students to connect the performance of standard and scientific notation calculations in mathematics class with the same concepts studied in science.

Communication played a key role during the *Sizing Things Up* video and *Penny Statistics* activity. These experiences allowed students to communicate their understanding of concepts, develop negotiation and interpersonal skills, and construct meaning through interaction with peers. Listening and participating in the various student group discussions was one of the most meaningful parts of the lesson. Students organized and consolidated their mathematical thinking, communicated ideas with peers and the teacher, analyzed their thinking and the thinking strategies of others, and used the language of mathematics to express ideas (NCTM, 2000). By interacting and posing several open-ended questions with the groups, the teacher was able to extend, enrich, and assess student understanding.

Pennies, Pennies, Everywhere!!! allowed students multiple opportunities to develop a deeper understanding of very large numbers and the various representations of them, reinforcing the 9th-12th grade Number and Operations Standard (NCTM, 2000). The calculations and conversions developed computational estimation skills using mental and paper-and-pencil computations, as well as technology for more complicated situations.

The Algebra and Geometry standards were an underlying thread in the lesson as students represented and analyzed mathematical situations by using algebraic symbols and language in their verbal and written expression of relations. Students used equations for converting money, changing metric and standard units, and using geometric formulas. The connection between the use of the algebraic equations, formulas, visualization, spatial reasoning, and geometric modeling, all Geometry Standards, allowed students to develop their problem solving skills. It also provided opportunities for them to solve problems in other contexts, apply and adapt a variety of appropriate strategies, and monitor and reflect on the process of mathematical problem solving as outlined in the Problem Solving Standards (NCTM, 2000).

The role of assessment is key in any lesson and may often be the driving force when selecting learning activities for classroom instruction. Assessment during the lesson was on-going and occurred as students completed various learning activities. The built-in check points, requiring the teacher's initials, served as formative assessments and allowed the teacher to assess student performance and provide individualized or small group instruction as needed. The summative assessment activity allowed the teacher to assess students' understanding of key mathematical concepts addressed in the lesson and focused on their ability to communicate these ideas in

writing. The true assessment of enduring learning was when students were able to communicate what they learned in their penny collection projects. After completing this lesson many students developed a different outlook on scientific notation, the value of a penny, and the value of participating in the school's penny collections. Several students commented that they couldn't wait to hear someone say "What's a penny worth anyway" or "It's only a penny" so that they could tell them all about the true value of a penny.

Author's Note: A copy of the complete lesson plan can be obtained at the Thinkport website. The following activities have been renamed or revised with the revised name in parenthesis: *Penny Statistics* (How Many Pennies…?), *To Infinity and Beyond…*(Pennies in Outer Space) and *Assessment* (Penny Donation Box). The *Numbers Alive!* series videos are available from the NETA Educational Resources website <http://www.netaonline.org>.

References

Maryland Public Television (Producer). (1995). *Numbers Alive! Sizing Things Up* [Television Series Episode]. Owings Mills: MPT.

National Council of Teachers of Mathematics. (2002). *Principles and standards for school mathematics.* Reston, VA: NCTM.

Staley, J. & Walls, E. (1999). *Pennies, Pennies, Everywhere!!!* [On-line]. Available: http://www.thinkport.org/Tools/ContentViewer/ContentPreview.aspx?ContentID=c6d2d31f-7ef2-46e2-9d52-5371666019ab

Mini-Grants from NCCTM

NCCTM is pleased to be able to offer Mini-Grants to teachers who need some support to implement an innovative idea at their schools. There are no preconceived criteria for projects except that students should benefit from the grant. Possible projects for consideration include math clubs, field days, contests, workshops for parents, math activities, math laboratories, and research topics.

Each of the three NCCTM state regions has $5000 to award to teachers in their area. The average mini-grant is about $600 but some have been awarded for as little as $100 or as much as $2000. Applications will be accepted only from persons who are NCCTM members as of 1 September 2005. Don't let the application process intimidate you! See the sample application on the website and use it as a guide!

Completed applications must be received by 15 September 2006 to be considered. For more information and submission guidelines, see the website <http://www.ncctm.org> or contact Phyllis W. Johnson <pwjohnson210@earthlink.net, 252-752-1796>.

The NCCTM Materials Marketplace

The Marketplace will be back this fall, and the organizers need your help! Please consider donating materials to the marketplace. We are looking for new or gently used supplies such as manipulatives, posters, books, professional development materials—anything that would be useful to new teachers.

Preservice and new inservice teachers will be invited to come and purchase at rock bottom prices all sorts of materials—textbooks, technology, supplies, etc.—to start building their resource base.

Please contact coordinators Kim Aiello and Shana Runge if you have materials to contribute.

<ncctmmarketplace@hotmail.com>

Sizing Things Up Activity Sheet

Use this space to record numbers and numerical terms mentioned in the video.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Video Segment 1:

1. How many people can Camden Yard seat? _____

Video Segment 2:

2. How many stadiums the size of Camden Yards would it take to seat 1 million people? Show your work, and explain how you got your answer on the lines below.

_____

_____

Video Segment 3:

3. How much money will Ben donate for each hot dog sold at the game? _____

4. What is the ratio of hot dogs sold to fans in attendance at the game? _____

$$\frac{\text{hot dogs}}{\text{fans}} = \_\_\_\_\_$$

5. What will the total of Ben's donation be? Show your work in the space below and explain your answer.

Penny Statistics (How Many Pennies…?) Activity Sheet

Directions: Today, you will use ratios and proportions to help you calculate the penny capacity of several objects. Perform all necessary measurements and calculations with the materials given to you in your kit. Now you are ready to begin your penny experience. Have fun counting!

Part A: Estimation

Use your estimation skills to fill in the blanks to the following statements.

1. There are _____ pennies in a one-inch stack.
2. It takes _____ pennies to cover the top of your desk.
3. It would take _____ stacked pennies to reach from the floor to the ceiling of your classroom.

Part B: Data Collection

4. Find the diameter of one penny. _____ inches
   We will call this "penny width" or penny_w. Use this information to complete the following ratios.

$$\frac{1\ \text{penny}_w}{\_\_\_\ \text{inch}} \qquad \frac{\_\_\_\ \text{penny}_w}{1\ \text{inch}}$$

$$\frac{\_\_\_\ \text{penny}_w}{1\ \text{foot}} \qquad \frac{\_\_\_\ \text{penny}_w}{1\ \text{yard}}$$

5. Find the height of one penny. _____ inches. We will call this "penny height" or penny_h. Use this information to complete the following ratios.

$$\frac{1\ \text{penny}_w}{\_\_\_\ \text{inch}} \qquad \frac{\_\_\_\ \text{penny}_w}{1\ \text{inch}}$$

$$\frac{\_\_\_\ \text{penny}_w}{1\ \text{foot}} \qquad \frac{\_\_\_\ \text{penny}_w}{1\ \text{yard}}$$

Check Point: Get your teacher's initials before you continue. _____

Part C: Box Capacity

Draw a sketch of the cardboard box your teacher has provided. Be sure to include accurate measurements of the length, width, and height. Convert your measurements into inches and penny_w or penny_{st}.

length = _____ inches = _____ penny_w

width = _____ inches = _____ penny_w

height = _____ inches = _____ penny_h

Find the perimeter, area, and volume for the box. Record your answers in inches, pennies, and dollar value. Show your work.

6. Box top perimeter = _____ inches = _____ $penny_w$. $_____

   Box top area = _____ $inches^2$ = _____ $penny_w^2$. $_____

   Box volume = _____ $inches^3$ = _____ $penny_w$. $_____

7. Find the box volume in $pennies_v$ ("penny volumes"),

   Box volume = _____ $penny_w^2$ x _____ $penny_h$ = _____ $penny_v$
   $_____

Check point: Get your teacher's initials before you continue. _____

Part D: Room Capacity

Draw a picture of your room. Be sure to include accurate measurements of the length, width, and height of the room. (If the room is not rectangular, use the area the teacher has marked as the "room area.") Convert your measurements into inches and $penny_w$, $penny_h$, and $penny_v$

room length = _____ inches = _____ $penny_w$

room width = _____ inches = _____ $penny_w$

room height = _____ inches = _____ $penny_h$

Find the perimeter, area, and volume for the room. Record your answers in inches, pennies, and dollar value. Show your work.

8. floor perimeter = _____ inches = _____ $penny_w$. $_____

   floor area = _____ $inches^2$ = _____ $penny_w^2$. $_____

   floor volume = _____ $inches^3$ = _____ $penny_w$. $_____

9. Find the room volume in $pennies_v$ ("penny volumes")

   Room volume = _____ $penny_w^2$ x _____ $penny_h$ = _____ $penny_v$
   $_____

Check point: Get your teacher's initials. _____

To Infinity and Beyond… (Pennies in Outer Space) Activity Sheet

Directions: Today, we will find a ratio to compare the size of our classroom to several celestial objects. Data for this activity can be found at http://www.seds.org/billa/tnp/overview.html. You should perform your calculations in scientific notation, since most of your data involves numbers of great magnitude.

Part A: First Things First

1. We must first convert our room volume from cubic inches to cubic kilometers. Use the data you gathered in yesterday's activity.

   Room Volume Conversion

   $$(\_\_\_\_\_\ \text{in}^3) \times \left[\frac{1\ \text{m}}{\_\_\_\ \text{inch}}\right]^3 \times \left[\frac{1\ \text{km}}{\_\_\_\ \text{m}}\right]^3 = \_\_\_\_\_\ \text{km}^3$$

2. How many classrooms would it take to fill a cube with sides the length of the diameter of the Earth?

   Volume of an Earth Cube = (diameter)^3 = (_____)^3 = _____ km^3

   $$\text{Number of classrooms that would fit in the Earth Cube} = \frac{\text{volume of Earth Cube}}{\text{volume of classroom}} =$$

Part B: Celestial Volumes

Directions: Now use the calculations from Part A and data from http://www.seds.org/billa/tnp/asteroids.html for asteroid data to complete the chart. Note: to compute the size of an object compared to Earth, use a ratio of the object's radius to the Earth's radius.

Celestial Object	Ratio of Object's Radius to Earth's Radius (E)	Number of Classrooms that would Fit in Object	Measurement of object in penny$_v$
Earth			
Venus			
Mars			
Jupiter			
Saturn			
Neptune			
Pluto			

Problems to Ponder

Fall 2006 Problems

Gregory S. Rhoads
Appalachian State University
Boone, North Carolina

Grades K–2	Alexis is 5 years older than her sister Katlynn, and 3 years younger than her brother Zac. If Katlynn is 8 years old, how old is Zac?
Grades 3–5	A tire store, a school, and a church all lie along Route 421, a perfectly straight road. If the distance from the tire store to the church is 7 miles and the distance from the tire store to the school is 3 miles, what is the least possible distance between the church and the school? Draw a picture of your answer with all three buildings.
Grades 6–8	Callie, Derrick, and Lilah are writing letters to the students at the local middle school. Derrick will write 5 times as many letters as Callie, and Lilah will write 2 times as many letters as Derrick. If they plan on writing 320 letters in all, how many will each person write?
Grades 9–12	An acute triangle has sides of length 60, 80 and 100 feet. A circle is centered at each vertex such that each circle is tangent (touches at one point) to the other two circles. What is the radius of the circle centered at the vertex opposite the side of length 60?

Directions for submitting solutions

1. Neatly print the following at the top of each solution page:
   - Your full name (first and last)
   - Your teacher's name
   - Your grade
   - Your school
2. Submit one problem per page.

Students who submit correct solutions will be recognized in the next issue of *The Centroid*. We publish creative or well-written solutions from those submitted. If you would rather not have your solution published, please so indicate on your submission. Keep in mind that proper acknowledgement is contingent on legible information and solutions.

Send solutions by 31 October to:

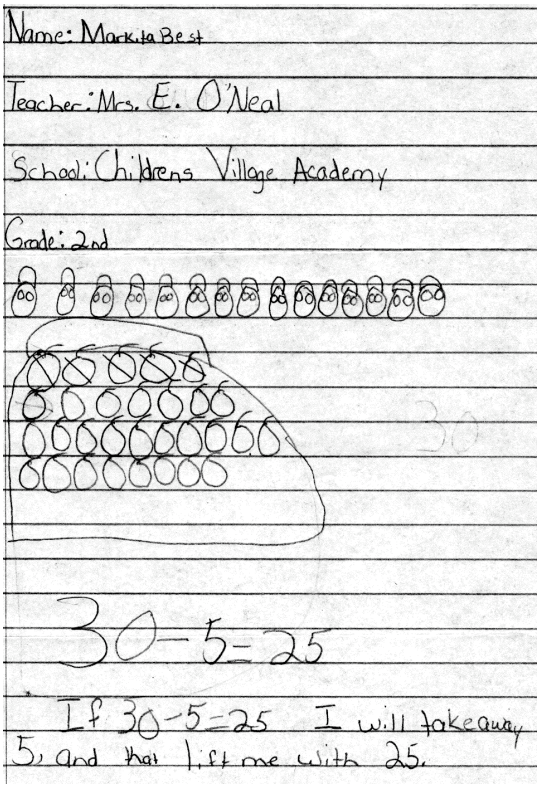
Problems to Ponder
c/o Dr. Greg Rhoads
Dept. of Mathematical Sciences
Appalachian State University
Boone, NC 28608

As these problems are intended to stimulate independent thinking, it is expected that a submitted solution indicates that the student completed a significant part of the work. Please try to have the students use complete sentences when they write up their solutions to promote effective communication of their ideas.

Solutions for Problems from the Spring 2006 Issue

Grades K-2

The Jones family has fifteen children. Each child goes to the local apple orchard, picks 2 apples, and places them all in a basket. They wish to share the apples with the Smith family, which has five children. Each of the Smith children takes one apple from the basket. How many apples are left in the basket for the Jones family?



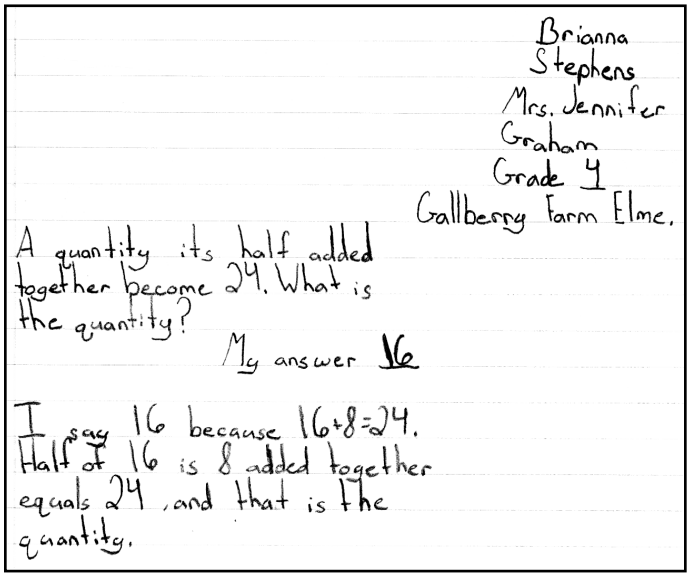
Solution: By Markita Best, 2nd grade, **Children Village Academy** (Teacher: Mrs. E. O'Neal)

Correct solutions were received from: Markita Best and Alexis McNeil of **Children Village Academy,** Gunner Price and Rickie Young of **Pines Elementary,** Brooks Hinshaw and Jay Hinshaw of **Siler City Elementary**, Luke Farlow, Lilah Ivey, Eric Sacchetti, Michael Salvaggio, and Kristen Serapin of **Wakefield Elementary.**

Grades 3-5

What is the smallest positive integer that has exactly 5 different integer factors (including 1 and itself)?

Solution: By Brianna Stephens, 4th grade, **Gallberry Farm Elementary** (Teacher: Mrs. Jennifer Graham).



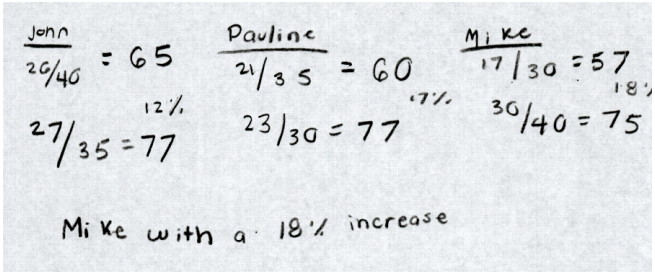
Correct solutions were received from: Sara Chenault, Will Pearce, Pooja Shah, and Anita Simha of **Davis Drive Elementary**, Scott Kallianas, Ally Merritt, Luke Oliver, Matthew Szolnoki, and Neusha Zadeh of **Easley Elementary**, Jonathan Bennette, Daniel Broadnax, Kennedy Cormier, Ayla Crum, Nicole Hawley, Madison Heffentrager, Megan Hoover, Calli James, Trae Lane, Wyatt Lemons, Sydney Painter, Melanie Pittman, Katlyne Preast, Ian Ramey, Kristen Roddy, Ashlee Shaffer, Kayla Strawhand, Kayla Trader, Coty White, Jeffrey White, and David Wilgus of **Moyock Elementary,** Michaelangelo Fields and Jordan Oliver of **Pines Elementary,** Dalton Flynn and Zachary Karabinus of **Vienna Elementary.**

Editor's Note: Some students noted that factors appear in pairs unless the number is a perfect square. Since I was looking for an odd number of factors, the integer must be a perfect square so these students checked 4, 9, 16 and were done. Very clever.

Grades 6-8

On their initial end of grade tests, John scored 26 out of 40, Pauline scored 21 out of 35 and Mike scored 17 out of 30. They were allowed to take the test again and John scored 27 out of 35, Pauline scored 23 out of 30 and Mike scored 30 out of 40. Which student had the largest increase in their percentage score on the test?

Solution: By Jennifer Bass, 7th grade, **Turrentine Middle School** (Teacher: Mrs. Durham).



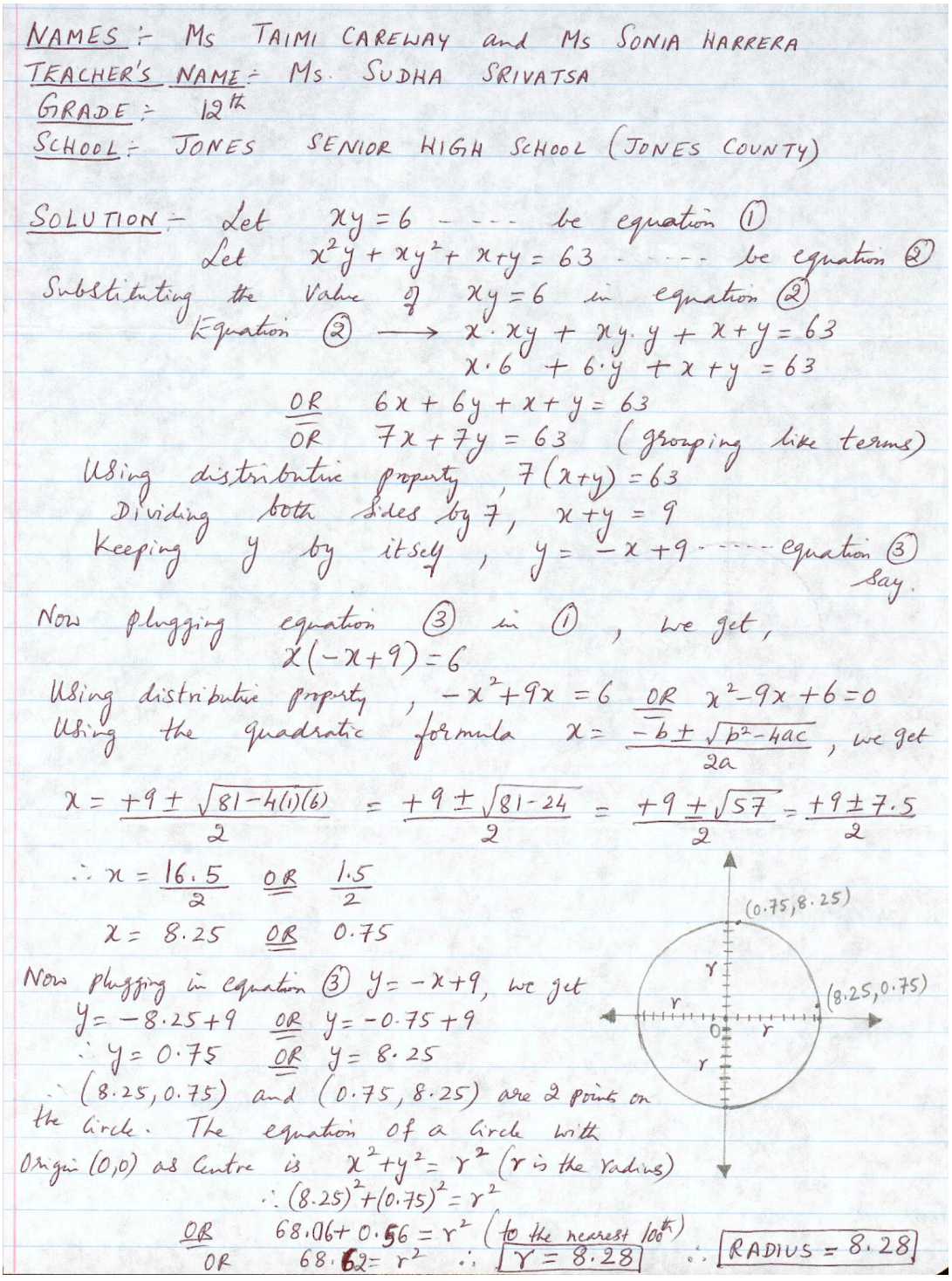
Correct solutions were received from: Salma Beck, Raina Gray, John Hudgins, Dylan Nichols, and Alex Shawver of **C. W. Stanford Middle,** Maria Carter of **Currituck Middle,** Ashley Dolan, Corrine Gach, Ali Hahn, Mackenzie Hines, Megan Hynell, Carson King, Nichole MacKay, Bryan Mixon, Kelly Nance, Autumn Nielsen, Lizzie Rossitch, Savannah Swift, and Collin Wilson of **Harris Road Middle,** Katie Autrey, Anthony Chambers, Christopher Cloninger, Aaron Cochran, Wesley Fox, Lauryn Green, Ta'Sarah Matthews, Lana Nye, Emily Phillips, Ashley Plover, Damion Seitz, Zachary Taylor, and Jay Young of **River Bend Middle,** Logan Hurley and Brooke Sebastian of **Southeast Middle,** Dimetris Anderson, Ty'Recus Arrington, Jasmine Barnes, Brianna Barryman, Ramone Battle, Chris'ta Bazemore, Maggie Belangia, Alexis Bond, Jasmine Bond, LaQuanshé Bond, Alanson Boone, David Brown, Nashara Bunch, Brittney Cherry, Samiya Crump, Tyleiseia Curry, Donte Downing, Amelia Evans, Savannah Fennell, Moniqua Flood, Kemonti Francis, Janelle Freeman, Justin Harmon, Zachary Harris, Cohen Harrison, Holley Harrison, Gentry Hassell, Lester Heckstall, Holley Howell, Shaunacee Howell, Jaelyn Johnson, Misty Keown, Chrishawn Lee, Janetta Lee, Shoyka McDowall, Chelsea Miller, Blake Mizelle, Jody Mizelle, Torrence Mourning, Riketta Norfleet, Monica Outlaw, Lyndsqé Peele, Derrick Pokes, Jasmine Powell, Kevin Purvis, Dominique Rankins, Wiklisha Riddick, Elton Rodgers, Jadale Smallwood, Aveale Smith, Terri Lynn Smith, Jasmine Speller, Saleesa Stocks, Jocqui Stokes, Erica Sutton, Zachia Sweet-Newkirk, Brandon Thomas, Patrelle Walton, Donnesha Watson, Shanequa Watson, Tesniequia Watson, Kennedy Wesson, Cody White, Khadijah White, Martynez White, and Quadedra Williams of **Southwestern Middle**, Will Anderson, Jennifer Bass, Shantell Bingham, Kayla Capps, Griffith Chandler, Zac Cowan, Graham Crawford, Jordan Crawford, Sylvia Foster, Michael Greer, Cierra Harris-Pinnix, Harris Hawks, Ben Johnson, Jake Jones, Allison Kelly, Anthony Long, Christopher Lupo, Jessica McBride, Stephen Moffitt, C. J. Moore, William Parker, Andrea Patrick, Eric Peavy, Neil Penley, Catherine Reece, Stephen Reeves, Robert Register, Dustin Resh, John Robinson, Niwae Sheikh, Jared Spencer, Allen Tate, Sara Toledo, Michael Touloupas, Tammy Van Biljon, Erin Van Fleet, Cody Wagoner, and Samantha Wilson of **Turrentine Middle.**

Editor's Note: There were many incorrect solutions to this problem and having different total possible scores on the exams caused many of the difficulties. A correct solution must include the calculation of each student's percentage score and the amount it increased.

Grades 9-12

If (x,y) *is a solution to the system of equations* $xy = 6$ *and* $x^2y + xy^2 + x + y = 63$*, then the point* (x,y) *must lie on a circle centered at the origin. What is the radius of this circle?*

Solution: By Taimi Careway and Sonia Harrera, 12th grade, **Jones Senior High** (Teacher: Ms. Srivatsa).



Correct solutions were received from:. Taimi Careway and Sonia Harrera of **Jones Senior High.**

Editor's Note: An alternative method is as follows: Follow Taimi and Sonia's solution to the equation $x + y = 9$, then note that $(x+y)^2 = 81 = x^2 + 2xy + y^2$ and use the first equation in the original problem to show that $x^2 + y^2 = 69$, so the radius is $\sqrt{69}$.

Women and Minorities in Mathematics

Incorporating Their Mathematical Achievements Into School Classrooms

Putting the Model in Mathematician Role Models

Sarah J. Greenwald[1]
Jill E. Thomley[2]
Appalachian State University
Boone, North Carolina

The National Council of Teachers of Mathematics suggests that "Students should have numerous and varied experiences related to the cultural, historical, and scientific evolution of mathematics so that they can appreciate the role of mathematics in the development of our contemporary society and explore relationships among mathematics and the disciplines it serves." (NCTM, 1999) Previous articles in this column have showcased classroom use of the lives and work of a woman or minority mathematician (Greenwald, 2006). This article is devoted to broader reflection about mathematician role models in the classroom.

Where do our students get their impressions of what mathematicians are like? Numerous women mathematicians, including one of the co-authors, have been told they don't look or sound like a mathematician. From research "We know that many students perceive mathematics as a discipline that is done by others rather than people like themselves. The 'others' may be the smartest students (Oakes 1990), boys (Meyer and Koehler 1990), or specific ethnic groups (Moody 1997)." (Wilson & Chauvot, 2000) While the importance of role models is well documented, students would probably place examples of exceptional women mathematicians such as Emmy Noether firmly into the category of 'others' who do math, and some authors note that these kinds of exceptional mathematicians can have negative influences on perceptions (e.g., Lynch, 2001). Nancy G. Leveson, a professor of computer science and engineering has said:

> *A well-documented phenomenon called the 'imposter syndrome' with an accompanying fear of being 'found out' is found in much higher percentages of women and minority students... White males have lots of successful men with whom they can identify - they benefit from the self-reinforcing concept that they 'belong.' On the other hand, women and minorities have few role models who have been successful before them, and they often feel like outsiders.* (1990)

Jocelyn Steinke, a professor of communication with specialties in science communication and the images of women scientists in the mass media, asserts that in the absence of real-life role models, children will construct mental models of women in science from the images they see in the popular media. She analyzed various portrayals of women scientists in television and film (1998, 1999, 2005). In one case study she used a framework of five themes derived from gender theory and previous literature on the experiences of women scientists in the U.S.: early encouragement in science, professional status, professional reputation, professional relationships, and the impact of personal relationships on professional goals.

Some of Steinke's themes are similar to concepts included in the Fennema-Sherman mathematics attitudes scales (1976), which assess several components deemed by mathematics

[1] *Associate Professor of Mathematics, Sarah Greenwald is a 2005 MAA teaching award winner, and she has spoken about the impacts of scientific representations on NPR's Science Friday.*

[2] *Jill Thomley is Associate Professor of Statistics and Associate Research Editor for the Journal of Developmental Education.*

educators as critical for success in math: attitude towards success in mathematics, mathematics as a male domain, parental support, teacher support, confidence in learning mathematics, mathematics anxiety, motivation for challenge in mathematics, and mathematics usefulness. In a more recent presentation Fennema discussed perspectives from many different fields regarding gender equity in mathematics and science, emphasizing the importance of using multiple approaches to further our understanding, and to address the questions about girls' study of and participation in mathematics (Fennema, 2002).

However, exposing students to role models who satisfy Steinke's and Fennema-Sherman's criteria will not necessarily result in a corresponding increase in the number of students who see themselves as part of the "in-group" who can be successful in mathematics. In its annual review of literature on women in engineering, the Society of Women Engineers (SWE) notes, "Simple one-shot exposure is probably not enough to get more girls involved in engineering programs. If that were true, then we would expect to see young female fans of *Star Trek Voyager*, with its strong female engineering characters, flocking to the field." (Frehill, 2006) The authors would go a step further and assert that for maximum benefit, students also need to be able to personally identify with mathematicians. In other words, they need both to see people who are like them doing mathematics in the same ways they do and to connect with them on a personal level.

The authors have applied all of these criteria in examining the representations of mathematically talented women in Hollywood (Greenwald & Thomley, 2006) and in developing a classroom segment on *What is a Mathematician?* (Greenwald, 2005). As one student remarked,

> *I thought that it was great that my mathematical style was so close to hers. It made me appreciate her way of thinking better, as well as my own way of thinking. I had never before really labeled my train of thought, but because of our studies I am aware of the way my mind works, and I find it very handy when I come across difficulties that I must deal with. Thanks!*

Many students only know about scientists and mathematicians from popular TV and movies. The purpose of these types of programs is to entertain, and fictional shows should not necessarily be held to some kind of role-model standard; instead it is our responsibility as educators to be proactive about these representations and to make an effort to include real-life history or other role models to balance these stereotypes. Any individual mathematician is likely to be a poor role model for the entire set of criteria presented here, because the issue of identification is very complex. Biographies and interview comments rarely address all of the points, and even if they did, students are likely to respond based on their own experiences; what inspires one student may not interest another. In order to ensure that all of our students will see themselves as part of the in-group who is capable of succeeding in mathematics, we can expose students to numerous role models with diverse styles and lives who collectively earn high marks. It is not only our students who benefit, as the future of our country ultimately depends on our ability to attract and retain talented people in science and mathematics.

References

Fennema, E. (2002). Gender Equity for Mathematics and Science [On-line]. Available: http://www.woodrow.org/teachers/math/gender/ 02fennema.html

Fennema, E. and Sherman, J. (1976). Fennema-Sherman Mathematics Attitudes Scales: Instruments Designed to Measure Attitudes Toward the Learning of Mathematics by Females and Males. *Signs: Journal of Personality and Social Psychology,* 7(5), 324-326.

Frehill, L et al., (2006). Women in Engineering: A Review of the 2005 Literature. *Magazine of the Society of Women Engineers*, Summer, 1-18.

Greenwald, S.J. (2005). Incorporating the Mathematical Achievements of Women and Minority Mathematicians into Classrooms. In R. Jardine & A. Shell-Gellasch (Eds.), *From Calculus to Computers: Using the Last 200 Years of Mathematics History in the Classroom*. Washington, DC: Mathematical Association of America [Reprinted On-line]. Available: http:// www.mathsci.appstate.edu/~sjg/history/womenrecenthistory2.pdf

Greenwald, S.J. (2006). NCCTM Centroid Columns and Classroom Activity Sheets. Available: http://www.mathsci.appstate.edu/~sjg/ncctm/activities/

Greenwald, S.J. & Thomley J.E. (2006). Mathematically Talented Women in Hollywood. Available: http://www.mathsci.appstate.edu/~sjg/simpsonsmath/wim.html/womenangel.pdf

Leveson, N.G. (1990). Educational Pipeline Issues for Women. *Computing Research News*, October [Reprinted On-line]. Available: http://www.cs.washington.edu/research/projects/safety/www/papers/snowbird.ps

Lynch, J. et al. (2001). Mathematics: a Dilemma for Feminists. In E.L. MacNabb et al. (Eds.),

Transforming the Disciplines. New York: Haworth Press.
National Council of Teachers of Mathematics. (1999). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: Author.
Steinke, J. (1998). Connecting Theory and Practice: Women Scientist Role Models in Television Programming. *Journal of Broadcasting and Electronic Media*, 42(1), 142-151.
Steinke, J. (1999). Women Scientist Role Models on Screen: A Case Study of Contact. *Science Communication*, 21(2), 111-136.
Steinke, J. (2005). Reinforcing Cultural Representations of Gender and Science: Portrayals of Women Scientists and Engineers in Popular Films. *Science Communication*, 27(1), 27-63.
Wilson, P. & Chauvot, J. (2000). Who? How? What? *Mathematics Teacher*, 93(8).

NCCTM Fall Conference

36th Annual Conference of the
North Carolina Teachers of Mathematics
Building Student Success Through Rich Mathematics
October 5 and 6, 2006

Keynote Speakers
Cathy Seeley, NCTM President 2004-06
Lee Stiff, NCTM President 2000-02

Joseph S. Koury Convention Center
Sheraton Greensboro Hotel at Four Seasons
Greensboro, North Carolina

On Site Registration Fees: $85 ($75 for members, $0 for students)

Pre-Registration: $65 ($55 for members, $5 for students). Forms are available on line <http://www.ncctm.org> and must be received by September 25th to qualify for the reduced rate.

Hope to see you there!

NCTM 2007 National Meeting

The national meeting will be held in Atlanta, Georgia on 24 through 24 March 2007. See the NCTM website for more details.

<http://www.nctm.org/>

2006 NCCTM State Math Fair Winners

Primary Division — Grades K-2

1st Place:
Austin Dagenhart
"Austin Numerals"
Cool Spring Elementary School
Cleveland, NC

2nd Place:
Autumn Jones
"Using Mathematical Concepts in Determining the Effects of Extreme Temperatures on Germination and Growth"
Pinnacle Elementary School
Pinnacle, NC

3rd Place (tie):

Jenny Graham and William Ray
"Go the Distance"
Meadowlark Elementary School
Winston-Salem, NC

Renzo Benavides
"Wing Angles and Air Flow Rate"
White Oak Elementary School
Edenton, NC

Honorable Mentions:

Michelle Hausman
"A Mathematical Journey"
Woodland Heights Elementary School
Mooresville, NC

M'Kayla Rodgers
"The Butterfly on the Coordinate Plane"
Williamston Primary School
Williamston, NC

Elementary Division – Grades 3-5

1st Place:
Joseph Andry
"Eggs, Eggs, Eggs"
Davidson Elementary School
Davidson, NC

2nd Place (tie):
Ryan Rackliffe
"Drafting: Will 2 Race Cars Go Faster Than 1?"
A.B. Combs Elementary School
Raleigh, NC

3rd Place:
Jessica Fletcher
"Time for the Metric System"
Lakeshore Elementary School
Mooresville, NC

Seth Archer
"Grinding the Gears"
Lake Norman Elementary School
Mooresville, NC

Honorable Mentions:

David Greene and Michael Gatlin
"Are You Ready for Some Football?"
Mt. Mourne Elementary School
Mooresville, NC

Mohamed Hassan
"Waves in a Ripple Tank"
A.B. Combs Elementary School
Raleigh, NC

Tabitha Phillips and Sarah Scott
(Mrs. Sandra Harris' class project)
"Losers 'R' Us"
Sheep Harney and P.W. Moore Elementary Schools
Elizabeth City, NC

Middle School Division – Grades 6-8

1st Place:
Rebecca Gregory
"Domino Physics"
Camden Middle School
Camden, NC

2nd Place:
Carly Schnitzler
"Pretty Kitty Mall Store"
The Academy at Lincoln
Greensboro, NC

3rd Place:
Sean Bullock and Trevon Brooks
"Does the Weight of an Airsoft BB Affect the Accuracy and Precision of the Gun?"
Topsail Middle School
Hampstead, NC

Honorable Mentions:
Melissa Sawyer
"I'm Lichen It"
Camden Middle School
Camden, NC

Katie Shuford
"The Magic of Music"
H.M. Arndt Middle School
Hickory, NC

High School Division – Grades 9-12

1st Place:
Maressa McCall
"Mathematical Musical Motifs"
A.C. Reynolds High School
Asheville, NC

2nd Place:

Brandon Broome and Justin Huntley
"Architectural Engineering: The Math Involved in the Design and Construction of a Bridge"
Victory Christian Center School
Charlotte, NC

3rd Place:
Bobby Schultz
"Unbreakable: The Guts of the RSA Cryptosystem, Securing Communication Using Modular Mathematics"
Raleigh Charter High School
Raleigh, NC

Honorable Mention:
Will Thomas and James Sims III
"The Mathematics and Physics of Roller Coasters"
Victory Christian Center School
Charlotte, NC

Call for Articles: 71st NCTM Yearbook

Understanding Geometry in a Changing World

The Seventy-first Yearbook Editorial Panel invites the submission of articles for the yearbook Understanding Geometry for a Changing World. Prospective authors should submit manuscripts for review by December 1, 2006. Contributions from classroom teachers, supervisors, teacher-educators, mathematicians, researchers, and teams are particularly encouraged.

For suggested topics and detailed submission instructions, see Guidelines for Preparing Articles for the Seventy-first Yearbook on NCTM's Web site <www.nctm.org/publications/yearbook.htm>. Questions about the guidelines should be addressed to Timothy Craine <crainet@ccsu.edu> or Rheta N. Rubenstein <rrubenst@umd.umich.edu>.

2006 State Mathematics Contest Results

Reported by
John Goebel, State Mathematics Contest Chair
North Carolina School of Science and Mathematics
Durham, North Carolina

The Comprehensive Contest

The 28th State High School Mathematics Contest was held on 27 April 2006 at the North Carolina School of Science and Mathematics in Durham. Students who placed in the top seven percent at one of the twelve regional contests held at colleges, universities, and community colleges within the state were invited to participate. One hundred eleven students from 40 high schools across North Carolina competed in this contest.

The 111 students competing this year included six students who recently took part in the USA Mathematical Olympiad and were invited to the Math Olympiad Summer Program, a three-week training session designed to train and select the six-member team that will represent the United States at the International Mathematical Olympiad this summer in Ljubljana, Slovenia. Six of the 54 students who attended this session are from North Carolina. These six students are Annav Tripathy, Noah Blach, and Jeremy Hahn from East Chapel Hill High School, John Pardon from Durham Academy, Yakov Berchenko-Kogan from Broughton High School and John Berman from J. T. Hoggard High in Wilmington. This year's comprehensive division winners were:

Comprehensive Contest
1st: John Pardon, Durham Academy.
2nd: Arnav Tripathy, East Chapel Hill High School.
3rd: Noah Blach, East Chapel Hill High School
4th: Vivek Bhattacharya, Enloe High School
5th: Jeremy Hahn, East Chapel Hill High School.

Algebra I, Algebra II, and Geometry

The State Finals in Algebra I, Geometry, and Algebra II were held at three sites: UNC-Asheville, UNC-Greensboro, and NC Wesleyan College on 4 May, 2006. The top ten percent of the participants at the local contests across the state were eligible to compete in these finals. This year's contest winners were:

Algebra 1 Division
1st: Christine Hong, Arendell Parrot Academy
2nd: Brendan Fletcher, Charlotte Home Educators
3rd: Time Jiang, Watauga High School
4th: Rachel Boy, Academy at Lincoln
5th: Nathaniel Swofford, Academy at Lincoln

Algebra II Division
1st: Tian-Yi Jiang, North Raleigh Christian Acad.
2nd: Mingwei Lei, East Chapel Hill High School
3rd: Pom McCabe, Pinecrest High School
4th: Michael Chang, New Hanover High School
5th Place: Haotian Lui, Providence Day School

Geometry Division
1st: Jenny Chen, Arendell Parrot Academy
2nd: David Lucia, Providence Day School
3rd: Katie Retting, Home School Fayetteville
4th: Alex Chin, Daniels Middle School
5th: Gray Symon, Smith Middle School

About the Contests

The State Mathematics Contest is sponsored by the North Carolina Council of Teachers of Mathematics. Additional funding from Duke Energy helps send the North Carolina ARML Teams to Pennsylvania. The Microsoft Office for North Carolina provided software awards for teachers of students competing in this contest. In addition, Duke University along with many other colleges and universities in North Carolina provide scholarships to winning students. Information on these scholarships is available at the contest website.

For more complete results in all division and for copies of the most recent tests with answers and solutions, please follow the link for the state contest on the NCCTM website:

<www.ncctm.org>.

North Carolina Team Wins ARML

Reported by
John Goebel, State Mathematics Contest Chair
North Carolina School of Science and Mathematics
Durham, North Carolina

The victorious North Carolina "A" team.

A team of students from across North Carolina defeated over one hundred teams from the United States, Canada, Taiwan, and the Philippines at the American Regions Mathematics League (ARML) Meet held on 3 June 2006. The meet was held simultaneously at three locations: The Pennsylvania State University, The University of Iowa, and The University of Nevada, Las Vegas.

Two teams were chosen to represent North Carolina at the ARML on the basis of their performance in the contests sponsored by NCCTM and on their scores on the various tests of the American Mathematics Competitions (AMC). The NCCTM sponsors sixteen regional qualifying contests culminating in the State High School Mathematics Contest. The top students at this contest were invited to be on the North Carolina "A" Team, this year's winning ARML team. The other fifteen students comprising the "B" team are typically younger students and are selected on the basis of their scores on a variety of contests, including those administered by the AMC.

The members of this year's winning team were:

John Berman, J. T. Hoggard
Vivek Bhattacharya, Enloe
Yakov Berchenko-Kogan, Broughton
Noah Blach, East Chapel Hill
Drew Boyuka, Charlotte Home Educators
Chelsey Cooley, NCSSM
Jeremy Hahn, East Chapel Hill
Mikail Lavrov, Enloe
Joe Lozier, NCSSM
Arnav Tripathy, East Chapel Hill
Daniel Vitek, Enloe
Bangchen Wang, AC Reynolds
Ray Wang, JH Rose
Amy Wen, NCSSM
Sunny Xi, J. T. Hoggard

The coaches for this year's teams were Archie Benton of North Buncombe High School in Weaverville, Ken Thwing of Freedom High School in Morganton, Kathy Hill and Deanna Lancaster of Athens Drive High in Raleigh, and David Mermin of Duke University. The coaches knew before heading to Pennsylvania that they had good teams. Many of the students on the team had competed last year at ARML and placed seventh. In addition, five of the team members

had already been selected to attend the training session for the USA Mathematical Olympiad Team this summer at the University of Nebraska. Only fifty-four students nationwide were selected for this practice/selection session and six of them were from North Carolina.

The ARML Competition is primarily a team event. Three of the four parts of the contest are done in teams. The Power Round lasts for one hour, and the students must write rigorous mathematical derivations and proofs. The Team Round last twenty minutes, and the students must collectively come up with answers to ten unrelated problems. The Relay Round consists of two problems which are done in relay fashion, with each student passing an answer on to another team member, who then uses that answer to complete his or her stage of the relay. The final round is the Individual Round in which each participant must answer eight questions. The North Carolina Team had the highest team score, the highest Power Round score, and the highest individual total of all the teams present.

The high scoring individual team members included John Berman, a 9^{th}-grader from J. T. Hoggard High School in Wilmington, Jeremy Hahn, a 10^{th}-grader from East Chapel Hill High School, Mikhail Lavrov, an 11^{th}-grader from Enloe High School in Raleigh, Arnav Tripathy, an 11^{th}-grader from East Chapel Hill High School, and Amy Wen of the North Carolina School of Science and Mathematics. The high scoring member of the "B" team was Steven Ji of the North Carolina School of Science and Mathematics.

The North Carolina Math Teams are sponsored by the NCCTM with generous support also coming from Duke Energy Corporation. For the past three years Duke Energy has provided additional funding so that this trip costs the individual students very little.

For more information contact John Goebel, Chair of the State Mathematics Contest Committee <goebel@ncssm.edu, 919-722-5225>.

NC DPI News and Notes

High School Graduation Requirements and Rigor, Relevance, and Relationships Policies

At its May meeting, the State Board of Education approved High School Exit Standards and a policy defining academic rigor, along with recommendations for increasing rigor in the classrooms. These policies will now start the APA approval process. The implementation date for High School Exit Standards is school year 2006-07. An implementation guide for the High School Exit Standards is being developed and will be distributed at a later date. For questions regarding these policies, please contact Wandra Polk <wpolk@dpi.state.nc.us>.

For other news and notes, check out the mathematics website at the DPI:

http://community.learnnc.org/dpi/math/

NCTM Position on High Stakes Testing

The National Council of Teachers of Mathematics recognizes the importance of measuring the learning of students and the effectiveness of instruction. Large-scale tests can and should be among several measures that are used to make significant decisions about students and instruction. However, such critical decisions about students and instruction must involve more than the results of any single test. We strongly support a balance of day-to-day classroom assessments, which help teachers improve instruction, and external tests that track progress and provide for national comparisons.

For more information on this and other positions adopted by NCTM, see the website:

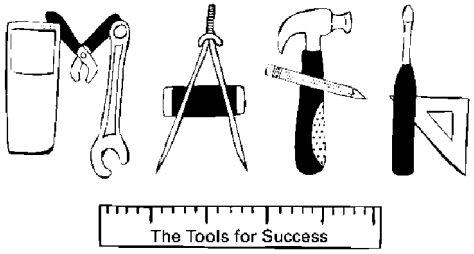
www.nctm.org

2006 Math Logo Contest Winners

From a field of approximately 2,900 entries, twelve logos submitted by the following students were judged to be the winners in the 2006 Logo Contest.

State Winner – Western Region

Kendrick McDowell, Grade 12
Kings Mountain High School
Kings Mountain, NC
Teacher: Jamey Anne Croft



Eastern Regional Finalists

Lauren Beamon, Grade 2
Snow Hill Primary School
Snow Hill, NC
Teacher: Carol Taylor

Logan Mizell, Grade 4
Lawrence Academy
Merry Hill, NC
Teacher: Sheryl Daughetry

Corey Stamper, Grade 6
Terrell Lane Middle School
Louisburg, NC
Teacher: Debra Frary

Yasmeen Kashef, Grade 10
J. H. Rose High School
Greenville, NC
Teacher: Sundra Pather

Central Regional Finalists

Noah G. McManus, Grade 1
Glendale Acres Elementary
Fayetteville, NC
Teacher: Laurel Cunningham

Miranda Freeman, Grade 5
West End Elementary
West End, NC
Teacher: Mrs. Dora Lancaster

Ryan Goins, Grade 8
Mount Airy Middle
Mt. Airy, NC
Teacher: Christeen Knight

Lissette Saca, Grade 10
East Chapel Hill High School
Chapel Hill, NC
Teacher: Beth Neil

Western Regional Finalists

Katie Bruce, Grade 2
Saint Mark Catholic School
Huntersville, NC
Teacher: Amanda Kaproth

Andrea Smith, Grade 5
Iron Station Elementary
Iron Station, NC
Teacher: Ms. C. Johnston

Ryan Callahan, Grade 8
Rugby Middle School
Herdersonville, NC
Teacher: H. Hamilton

Kendrick McDowell, Grade 12
Kings Mountain High School
Kings Mountain, NC
Teacher: Jamey Anne Croft

Rankin Award Nominations

The Rankin Award is designed to recognize and honor individuals for their outstanding contributions to NCCTM and to mathematics education in the State. Presented in the fall at the State Mathematics Conference, the award, named in memory of W.W. Rankin, Professor of Mathematics at Duke University, is the highest honor NCCTM can bestow upon an individual.

If you have nominated someone in the past who has not received the award to date,
or if you would like to nominate someone now,
please submit as much of the following information as possible.
Nominations are accepted at any time.

Nominations should include the following information. Use as many typewritten pages as needed. If possible, attach a vita of the nominee.

Name of the nominee

Current position

Your relationship to the nominee (e.g. principal, co-worker, etc.)

The nominee's contributions to mathematics education, NCTM, NCCTM, etc. (Please include information on specific offices held and honors received by the nominee.)

Any information about contributions to the community, teaching, and education that would be of value to the Rankin Award Committee in its deliberations

Other relevant information

Letters of endorsement from other colleagues may be included.

Date of nomination

Nominator* Name

Current position

Business or educational institution

Preferred mailing address

Preferred telephone number

*The Rankin Award Committee reserves the right to use portions of nomination information in the presentation of the award if the candidate is selected.

Send to: Dr. Ralph DeVane
P. O. Box 1762
Cullowhee, NC 28723

Innovator Award Nominations

The North Carolina Council of Teachers of Mathematics accepts nominations for the Innovator Award at any time. The purpose of this award is to recognize and reward individuals or groups who have made an outstanding and noteworthy contribution to mathematics education and/or NCCTM by having founded, initiated, pioneered, or developed some program in mathematics education of service to a geographic region of the state or the entire state. Further, this program must have been sustained for a period of at least three years. A number of organizations have made significant contributions to mathematics education in North Carolina; the Committee encourages the nomination of organizations as well as individuals. Any NCCTM member may submit nominations by sending in the form below. Nominations will be retained in the active file for at least three years.

Nomination Form

Name of Nominee_____

Present Position_____

Outstanding contributions to mathematics education in North Carolina which serves as the basis for this nomination:

Additional information that would be of value to the selection committee:

Signature:_____Date:_____

Name (print/type):_____

Position:_____

Business or Institution:_____

Address:_____

Phone: Business:_____ Home: _____Email:_____

Send to: Phillip Johnson, Math and Science Education Center,
ASU Box 32091 Boone, NC 28608-2091

NCCTM Trust Fund Scholarship

$500 scholarships are available from NCCTM to financially support North Carolina teachers who are enrolled in graduate degree programs to enhance mathematics instruction.

Applicants must be:
- Currently employed as a pre-K-12 teacher in North Carolina;
- Currently an NCCTM member (for at least one year) at the time of submitting this application;
- Currently enrolled in an accredited graduate program in North Carolina;
- Currently enrolled in a mathematics or mathematics education course, or have completed a mathematics or mathematics education course within the previous four months of the application deadline.

Applications will be reviewed biannually, and the deadlines for applications are:
- **March 1**
- **October 1**

Send completed applications to:
NCCTM Trust Fund Chairperson
6520 West Lake Anne Dr.
Raleigh, NC 27612

Direct inquiries to:
John Kolb, Chairperson
Phone: (919) 787-8116
E-mail: JKolb1@nc.rr.com

(Please print all information.)

PERSONAL INFORMATION:

Name:_____

Home address:_____

Home phone:_____ Home e-mail:_____

NCCTM membership number:_____

EMPLOYMENT INFORMATION:

How many years of teaching experience?_____

Currently employed in what school system?_____

School name:_____

School address:_____

School phone:_____ School e-mail:_____

Current teaching assignment:_____

Principal's name:_____

COURSE INFORMATION:

Institution of higher education:_____

Graduate degree program in which you are currently enrolled:_____

Course name:_____ Course number:_____

Dates of enrollment: *(circle one)* Fall semester Spring semester Summer session Year:_____

Name of course instructor:_____

PROFESSIONAL ACTIVITIES WITHIN PAST 5 YEARS:

BRIEF STATEMENT OF FUTURE PROFESSIONAL GOALS:

REQUIRED SIGNATURES:

Applicant's Signature:_____Date:_____

Principal's Signature:_____Date:_____

Instructor's Signature (if currently enrolled):_____Date:_____

REQUIRED ATTACHMENTS:
Please attach a copy of verification of acceptance and enrollment in accredited graduate program in North Carolina.

NOTE: Applications must be complete to be considered. If your application is approved, an official course grade report must be submitted to verify successful completion of the course before scholarship funds will be issued.

NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS

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Name: _____ Home Telephone: (____) - _____

Address:_____ School Telephone: (____) - _____

City: _____ State: _____ Zip: _____ E-mail: _____

School System: _____

POSITION
- ❑ Teacher
- ❑ Department Chair
- ❑ Supervisor/Administrator
- ❑ Full-time College Student
- ❑ Retired
- ❑ Other _____

LEVEL
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❑ 1 year:	$10.00	_____
❑ 3 years:	$25.00	_____
❑ 10 years:	$75.00	_____
❑ Full-time Student:	$5.00	_____
❑ Contribution to Trust Fund:		_____
Total Payment Enclosed:		_____

Payment by ❑ Check ❑ Visa ❑ MasterCard

Card # _____

Exp. Date _____

Signature _____

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