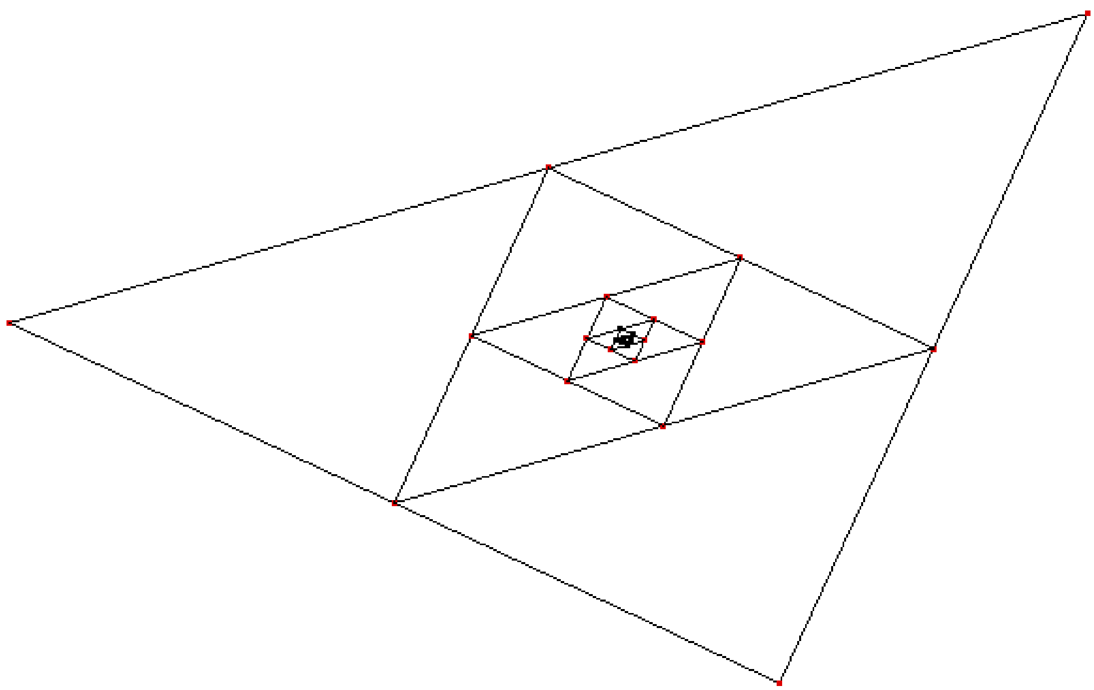
The Centroid



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- **2004 Outstanding Elementary Teachers**
- **2004 W.W. Rankin Memorial Award Winner**
- **2004 Innovator Award Winner**

OFFICIAL JOURNAL OF THE NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS
VOLUME 31 • NUMBER 1 • SPRING 2005

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

The Editorial Board invites 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 five (5) printed copies OR one electronic copy via e-mail attachment 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 the title page.

Manuscripts should not exceed 10 pages and should be word-processed, single-sided, and double-spaced with 1.5-inch margins. Figures should be on separate sheets. Photographs should be large glossy prints or minimum 300 dpi tiff files. Proof of the photo-grapher's permission is required. For photos of students, parent or guardian permission is required.

Manuscripts should follow the 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 conform to APA style guidelines:

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*.

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.

Contact Information

Address all correspondence and submissions to

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Boone NC 28608-2092

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

The Centroid

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Articles

News & Information

From the Editor

The New North Carolina Curriculum

Holly Hirst
Appalachian State University
Boone, North Carolina

Another school year is upon us, and many teachers are facing new challenges in the classroom brought on by preparing for the new North Carolina mathematics curriculum. In particular, the grades 9-12 courses in Discrete Mathematics and Advanced Functions and Modeling are ramping up in preparation for the new college admission requirements that start effective fall 2005: All students applying for admission to UNC colleges and universities will be required to have four course units of math, instead of three.

The Centroid would like to provide a venue for exchange of ideas among these teachers, and so we are asking those of you with class-tested ideas to send us a write up! We will help you prepare it for the 2005 issues of the journal. Contact us for more information at the e-mail address provided.

We hope you enjoy the articles in this issue. Two of the articles (*Discovering Mathematics* and *Closed-Form, Recursion, and Mindreading*) deal with issues related to sequences and recursion – topics in Goal 3 of the discrete mathematics course. The Women and Minorities column highlights nurse Florence Nightingale's contributions to statistics. *Mathematics: How Sweet it is* examines children's literature that uses candy to assist with learning math.

In honor of NCCTM's 35th year in 2005, we have included an article recapping the history of the NCCTM Trust Fund Scholarship program, which celebrates five years of operation in 2004.

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.
- **serving on the editorial board** – we are interested in adding several K-12 teachers to the board. If you are interested in serving on the board, send me e-mail.

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

Presidents' Messages

State President
Jan Wessell

The time has flown! It is difficult for me to believe that this is the last message I write as president of your organization. Surely, I have mixed emotions as the responsibility of this job is awesome, and I am getting older! I have had to make some difficult decisions. At the same time the rewards have been overwhelming, continuous, and constant.

The Board with whom I have worked has been terrific. Each member has contributed to our organization and made a difference in making the hard decisions you elected them to make. I appreciate the Board's work and the work of the many committee chairpersons who make NCCTM operate smoothly and efficiently. You can't imagine the countless hours that these members have volunteered to help NCCTM conduct business in its usual and customary, professional manner.

I must thank the past presidents for the direction and focus they gave me throughout my two years as president. I never imagined the many scenarios I would have to face, but the precedence was set. Their good decisions made my decisions easier. My admiration for all officers has grown tremendously as has my love for the work that NCCTM does.

One of the greatest needs I see for NCCTM is to engage young people in the jobs of the organization. Many of the present leaders are retired or close to retirement, having served NCCTM tirelessly. But, to keep NCCTM a dynamic force in North Carolina, we need young people who are willing to assume leadership positions. I hope you will be willing to contact the organization through the website and volunteer your service. I have had several such requests and have gladly found leadership positions for those who inquire.

Secondly, I see a need for NCCTM to become more responsible in the efforts to recruit and retain good mathematics teachers. I believe that our organization has a great deal to offer initially certified teachers as well as those who wish to join the profession. I hope we will continue to make an effort to provide special workshops and sessions for these new teachers and to encourage them to stay in the profession. With your help, we can make a difference across North Carolina.

Lastly, I see a need for NCCTM to insist that our students receive a rigorous mathematics education. Our knowledge base of mathematics is clearly not enough when I envision the challenges that our young people will face in years to come. Their knowledge base must be strong and well rounded, complete with concepts that I can't imagine. Our conferences and mini-conferences must help our teachers grow in their mathematics knowledge and stay current with changes and newly developed concepts. Mathematical literacy empowers us and will empower our students. It is clearly our responsibility to make it happen by participating in professional staff development and providing these experiences for our members.

In closing, I thank you for giving me the opportunity to serve you as President of NCCTM. I have enjoyed my years of service and have grown both personally and professionally.

Eastern Region President
Kathryn Hill

Greetings, Eastern Region members. I hope your Fall semester has gone well.

Thank you to everyone who presented at the NCCTM State Conference in Greensboro this past Fall. We had a great conference that was well attended. I left with lots of wonderful ideas, teaching samples, and new contacts.

Rose Sinicrope and Ray Jernigan have graciously agreed to chair our first ever Central/Eastern Regional Combined Spring Conference. Meredith will host the conference on Saturday, February 26. Our theme of “Algebra for All” should provide lots of interesting and usable ideas for the classroom. Please contact Rose or Ray if you are interested in speaking at the conference. We are very excited about having the two regions come together for the spring conference.

Please check the DPI website for regional contest sites and encourage your teachers to take teams to mathematics contests. Students enjoy participating at various levels of competition and can advance to the state finals. This is a great opportunity for our students who excel at math and competition can motivate others to reach this level.

It has been my pleasure and privilege to serve as your President for the past two years. Thank you for all your help, and I appreciate your dedication to mathematics education.

Central Region President
Vicki Moss

This year the Central and Eastern Region will sponsor a joint Regional Conference on Saturday, February 26, at Meredith College. The theme of the conference is “Math for All.” The focus will be on NCTM’s algebra standards: patterns; relations and functions; algebraic representations; mathematical models; and analysis of change in various contexts. Registration for the conference will be mailed to members and available on the NCCTM website in mid-January.

With the recent revisions in the mathematics curriculum, teachers at all grade levels, particularly middle school, need to be familiar with algebraic concepts. More importance is being placed on the teaching and understanding of Algebra. Recently the US Department of Education and the NC State Board or Education approved Algebra I as the assessment to be used for the AYP math requirement at high school. It is important that algebraic concepts begin in the primary grades to give students the foundation they need to be successful in higher-level mathematics courses.

We appreciate all the time and effort Stacy Elliot has given to the Central Regional Math Fair in the past. This year, Wendy Rich will chair the Central Regional Math Fair. The tentative date for the Math Fair is April 2. Information about Math Fair will also be available after the first of the year. Let me encourage teachers to get their students involved in math projects and consider submitting the projects for the Math Fair. This is a great way for children to see practical applications of mathematical concepts.

We look forward to seeing you at the conference.

Western Region President
Betty Long

Many exciting NCCTM activities and events are happening in the western region this spring. They include the 2005 Western Region Mathematics Conference, the Western Region Mathematics Conference for Pre-service K-8 Teachers, and the Western Region Math Fair.

The 2005 Western Region Mathematics Conference will be held on Saturday, February 26, at the Hickory Metropolitan Higher Education Center on the east campus of the Catawba Valley Community College. The theme will be “Assessment and the Newly Revised Standard Course of Study in Mathematics.” Bill Scott, Linda Patch, Toni Meyer, Jeane Joyner, and several K-12 teachers will share information and activities by grade level bands on ways to assess student progress in mathematics. Check-in will be at 8:30 a.m. in the lobby of the Hickory Metropolitan Higher Education Center. Sessions will begin at 9:00 a.m. and end at 1:00 p.m. Brochures and registration forms will be mailed to all western region members and curriculum coordinators in early January. The deadline for pre-registration is February

4, and there is a ten-dollar registration fee. For more information and a registration form, contact Dr. Betty B. Long <longbb@appstate.edu, phone: 828-262-2372, FAX: 828-265-8617>.

I hope to see all of you at this conference. We are quickly approaching the time when the end-of-course/grade tests will reflect the new SCOS for mathematics, and the sessions at this conference will provide valuable information to help you prepare your students for these new assessments.

We are continuing a tradition of the last two years by offering a conference specifically for pre-service K-8 teachers. In the past, this conference has been held on a different day from the Western Region Mathematics Conference. However, this year it will also be on Saturday, February 26 at the Hickory Metropolitan Higher Education Center on the east campus of the Catawba Valley Community College. The theme will be "Getting Started in the Teaching Profession." Sessions will be in the form of seminars and workshops for pre-service teachers in Grades K-8. Experienced classroom teachers will share their strategies for success and some mathematics activities that have worked well for them. For more information and a registration form, contact Dr. Deborah A. Crocker <crockerda@appstate.edu, phone: 828-262-2381, FAX: 828-265-8617>.

The third mathematics event of the spring will be the 2005 Western Region Math Fair, which will be held on Saturday, March 19 (snow date: April 2), in the Plemmons Student Union at Appalachian State University in Boone. For more information and a registration form, contact Dr. Betty B. Long <longbb@appstate.edu, phone: 828-262-2372, FAX: 828-265-8617>. Also, you can visit the website NCCTM.org for the latest updates.

In closing, I would like to take this opportunity to thank all of you who have helped me during my term as the NCCTM Western Region President. In particular, I appreciate all of the support I received from the western region officers -- Debra Harwell-Braun, Cindy Robinson, Tony Sapp, Charles Wallis, and Vicky Smathers. I would also like to thank Debbie Crocker who served as program chair for the 2004 and 2005 Western Region Mathematics Conferences for Pre-Service K-8 Teachers. I hope the mathematics events and activities that we planned and executed during the last two years in the western region have been helpful to many of you. I hope to see all of you at one or more of the mathematics events planned for this spring, and I would like to strongly encourage you to be actively involved in NCCTM.

NCCTM Regional Math Fairs

Each spring, the NCCTM Regions sponsor Student Mathematics Fairs. Students attending school in North Carolina are eligible to enter. Projects may be entered in the following categories:

Grades K-2 (Individual or Class Projects)	Grades 3-5 (Individual or Class Projects)
Grades 6-8 (Individual Projects)	Grades 9-12 (Individual Projects)

Class projects must involve a majority of the students in the class. Individual projects may involve one or two students only. Projects must be pre-registered to be accepted for the competition, and there is a limit of 9 projects per category per school. Some examples of ideas that can be explored include:

- Original games, puzzles, geometric explorations
- Experiments in estimation, numeration, measurement, and problem-solving
- Applications of math in navigation, astronomy, economics, photography, music, etc.
- Concrete or visual models
- Analysis, Trigonometry, Topology, Statistics, Probability

The Math Fair Committee and/or Judges reserve the right to re-categorize entries. They also reserve the right to limit or eliminate the awards presented in a given category, based on quality or quantity of projects submitted.

Judging will be based upon the following criteria:

A. Written Documentation, which must include:
   1. Origin of idea
   2. An outline of the development of the project
   3. Discussion of mathematical concepts investigated
   4. References used including names of resource people

B. Oral presentation, which must include:
   1. Clear and well organized discussion of mathematical concept presented
   2. Response to evaluator's questions

C. Development and demonstration of mathematical concepts in an effective manner
D. Investigations which extend beyond the student's everyday class investigations
E. Student creativity
F. Organization of ideas, thoroughness, and clarity
G. Appearance

Physical Specifications for Exhibits:

Size: All projects must be displayed on a project board. Maximum display dimensions: One (1) meter in width (side to side); One (1) meter in depth (front to back); One (1) meter in height. Special equipment (computer, power strip, etc.) must be supplied by the presenter.

Labels: Each project must be labeled with a 3 x 5 index card with the following information:

A. Name of person(s) or class	D. Teacher's name
B. Course and/or grade level	E. School and school system
C. Category of project	F. City and County

Projects that fail to meet these requirements will not be judged. Students must be present when judging begins and must be available to discuss their project. No adults other than judges may be present during the judging.

The regions have slightly different logistical arrangements; please consult the table below, and fill out the appropriate registration form to enter each project.

	Eastern	Central	Western
Submission Deadline:	March 9	March 10	March 1
Competition Date:	Friday, March 19	Saturday, April 2	Saturday, March 19 (snow date: April 2)
Location:	Bate Building, East Carolina University	Greensboro College	Plemmons Student Union, Appalachian State Univ.
Registration Time:	8:00-8:45 a.m.	9:30-10:00 a.m.	9:00-9:30 a.m.
Contact:	Bobbie Parker <parkerb.bco@bertieschools.com>	Wendy Rich < >	Betty B. Long <longbb@appstate.edu >

WESTERN REGION MATH FAIR REGISTRATION FORM

All entries must be postmarked by **March 1, 2005**. Return this form to:

Betty B. Long
Appalachian State University
Dept. of Mathematical Sciences
Boone, NC 28608

E-Mail: longbb@appstate.edu
Fax: 828-265-8617
Phone: 828-262-2372

Name of Student(s) ____________________________________

Name of Teacher ____________________________________

School ________________________ School Phone __________

School Address ____________________________________

Teacher's E-Mail address ______________________________

Please check the category of the project: _____ K-2 _____ 3-5 _____ 6-8 _____ 9-12

Will your project require electricity? ___ Yes ___ No

There will be a $6.00 registration fee for each student entering a project. Lunch will be provided for participating students.

_____# of people preferring a vegetarian lunch

_____# of students attending at $6.00 each. Total enclosed: $__________

(Checks payable to NCCTM Western Region Math Fair must be mailed with this form.)

CENTRAL REGION MATH FAIR REGISTRATION FORM

All entries must be postmarked by **March 10, 2004**. Return this form to:

Stacy Elliott	E-Mail: stacy.elliott@dpsnc.net
808 Burch Avenue	**Fax: 919-560-2217**
Durham, NC 227701	Phone: 919-560-3926 ext. 23484

Name of Student(s) ______________________________

Name of Teacher ______________________________

School ____________________ School Phone __________

School Address ______________________________

Teacher's E-Mail address ______________________________

Please check the category of the project: _____ K-2 _____ 3-5 _____ 6-8 _____ 9-12

Will your project require electricity? ___ Yes ___ No

There will be a $6.00 registration fee for each student entering a project. Lunch will be provided for participating students.

_____# of people preferring a vegetarian lunch

_____# of students attending at $6.00 each. Total enclosed: $__________

(Checks made payable to NCCTM Central Region Math Fair must be mailed with this form.)

EASTERN REGION MATH FAIR REGISTRATION FORM

All entries must be postmarked by **March 9, 2004**. Please duplicate this form for each project as needed. Return this form to:

Bobbie Parker	E-Mail: parkerb.bco@bertieschools.com
Bertie County Schools	**Fax: 252-794-9727**
P.O. Box 10	Phone: 252-794-6002
Windsor, NC 27983	

Name of Student(s) ______________________________

Name of Teacher ______________________________

School ____________________ School Phone __________

School Address ______________________________

Teacher's E-Mail address ______________________________

Please check the category of the project: _____ K-2 _____ 3-5 _____ 6-8 _____ 9-12

Will your project require electricity? ___ Yes ___ No

What do Dogs, Cats, Fire Hydrants, and Princesses Have to do With Geometry?

Karan B. Smith[1]
The University of North Carolina at Wilmington
Wilmington, North Carolina

As part of my teaching assignment, I have the privilege of working with undergraduates in mathematics seeking teacher licensure at the secondary level. During the last semester of their senior year, these students complete 12 hours of practicum in which they teach in a local public school under the support and direction of an established teacher, the partnership teacher. My role has been to serve as the university supervisor for many of these semester assignments. This role offers me wonderful opportunities to observe these interns as they develop content knowledge, pedagogical under-standing, and professional relationships. Another special component of my position are the occasions that I have for getting to know some of the exceptional high school mathematics teachers in our area and some of their novel teaching ideas.

I was recently making one of my regular classroom visits at Ashley High School in Wilmington, North Carolina for the purpose of observing the intern, when I noticed numerous colorful creations sitting on tables, desks, windowsills, and any other spaces that could be found. What types of creations? A bright red STYROFOAM™ fire hydrant made with cylinders and hemispheres; a pink pig made with a thick cylinder for the body, a sphere for the head, triangular pyramids for the ears, and thin cylinders for the legs; a polka-dotted white and black kitten; television models including antennae and control knobs; a heavy cardboard refrigerator covered in aluminum foil with a door that opens to reveal a shelf holding a Sierra Mist™ drink can; dogs of different sizes and shapes; a castle that looked like something from a fairy tale; a princess dressed in turquoise blue, perhaps from the same fairy tale; a SpongeBob Squarepants™ model; human-looking characters with varying personalities emanating from their geometric bodies and clothing accessories; and modern-looking models of buildings made with brightly colored geometric shapes of heavy cardboard.

I soon realized that these creations were student projects completed as part of their geometry course. Students were very interested in each other's projects and very ready to share information about their own work. As I talked to the teacher, Ms. Susan M. Robbins, concerning the assignment, I found that the project was not only an activity that really interested the students, but was mathematically rich and the components of the assignment encouraged good problem-solving methods and critical thinking challenges. When I suggested to Ms. Robbins that her project idea was one that should be shared, she kindly agreed and that is how this manuscript came to be.

Table 1, at the end of the article, provides the component parts of the assignment as given to the geometry students. The assignment is given to students at the beginning of their study of the unit on geometric solids. Students are required to complete their projects by the day after the written test on this unit. Typically, students have approximately 10 to 12 days for completion.

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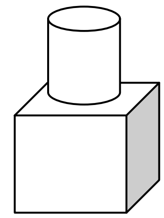
[1] *Dr. Karan B. Smith is an Associate Professor specializing in mathematics education, with interests in technology in the classroom, measurement and evaluation, and curriculum development.*

In its publication *Principles and Standards for School Mathematics,* the National Council of Teachers of Mathematics (NCTM, 2000) identifies major goals for students studying geometry. The learning of geometry should require students to use visualization, spatial reasoning, and geometric modeling to solve problems. This project requires students to use both visualization and spatial reasoning in the creation of their models and also in their sketches of the various views from the top, side, and front of the object. Students should gain quite a bit of insight into the properties of the different solids through the design and actual construction of these creations. As part of their written work, students are required to provide specific measurements for the completed project.

In addition, the Measurement Standard for Grades 9-12 outlines the importance of students learning the appropriate methods and formulas for measuring "the area, surface area, and volume of geometric figures, including cones, spheres, and cylinders." With this project, students are required to provide linear measures for the three views of their creations, as well as area measures for the total surface area and volume measures for the total volume.

Not only does the project support the intent of this standard, it also stimulates students to develop and use critical thinking skills when determining these values. Often, with these figures, when three-dimensional shapes combine to form a model, the total surface area of the model will not equal the sum of the surface areas of the component parts. For example, as in the figure below, if a cube and a cylinder are attached in a way such that the cylinder is sitting on top of the cube, then the surface area of the final model must exclude the area of the circle that is the base of the cylinder. This circular area would need to be deducted twice if the student is determining the total surface area by determining surface areas of component parts (once from the total surface area of the cylinder and once from the total surface area of the cube).



In the newest version of the North Carolina Mathematics Standard Course of Study for grades 9-12 defined for Geometry (North Carolina Department of Public Instruction, effective 2005), both of the following objectives are integral to students completing this project.

> 1.02 Use length, area, and volume of geometric figures to solve problems. Include arc length, area of sectors of circles; lateral area, surface area, and volume of three-dimensional figures; and perimeter, area, and volume of composite figures.
> Develop and apply properties of solids to solve problems.

Also, as students draw and identify dimension measures for the top, side, and front views of their models, they are illustrating their understanding of the following objective related to two-dimensional geometry.

> 2.03 Apply properties, definitions, and theorems of two-dimensional figures to solve problems and write proofs:
> Triangles.
> Quadrilaterals.
> Other polygons.
> Circles.

Students are also provided the breakdown, as seen in Table 2 at the end of the article, that the teacher uses to assess their final project, based on a total of 100 points.

Students are required to present their creations to the class and in doing so, explain how the final product was created, their sketches providing the various views of the product and how their calculations were determined. Each of these components of the presentation supports the NCTM Standard of Communication. In this Standard, expectations are outlined with the recommendations that students should

- be able to organize and consolidate their mathematical thinking through communication;
- communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- analyze and evaluate the mathematical thinking and strategies of others;
- use the language of mathematics to express mathematical ideas pre-cisely.

Both the teacher and students are provided time to ask the student questions related to the student's work. Frequently, the teacher asks specific questions that require students to expand on their explanations or more clearly explain certain aspects. The teacher also has a whole class discussion about the process, the product, and any problems that the students may have encountered at three times during the project: at the time of the initial assignment, midway during the project, and at the project's conclusion.

In summary, assignments like the project described here are exemplary mathematical tasks. In order to complete the assignment, students are required to incorporate essential mathematics content in geometry with the use of visualization, spatial reasoning, and critical thinking. In addition, students are required to communicate mathematics effectively in both written and oral forms. Hopefully this description of the geometric modeling assignment will encourage other teachers to develop, utilize, and share similar mathematics activities for the classroom.

References:

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics: Overview, Standards for Grades 9-12*. [On-line]. Available: http://standards.nctm.org/document/chapter7/ geom.htm (Geometry) and http://standards.nctm.org/document/chapter7/meas.htm (Measurement).

North Carolina Department of Public Instruction. (effective 2005). *North Carolina standard course of study: Mathematics, Geometry, High School Grades 9-12*. [On-line]. Available: http://www.ncpublicschools.org/curriculum/mathematics/standard2003/47geometry.html.

Project Details: Building a Three Dimensional Geometric Model:

* You will create a composite 3-dimensional figure and find the surface area and volume.
* You will present your creation to the class and turn in your creation with supporting paperwork on the due date.
* You will receive a grade that will count as

____

Table 1

Creation:

Your 3-D creation should:
* Be named and decorated
* Be a composite solid figure containing *at least* 3 different solids (differently sized

rectangular prisms count as only 1 of the 3 solids)

Paperwork:
Support for your creation should include:
* A list of all solid figures used in your creation's construction
* Sketches of different views of the creation (top, front, side) labeled with the appropriate dimensions
* Formulas and calculations for the total surface area and volume of the creation

Presentation:
You will:
* Present your creation to the class (1-2 min.)
* Explain the construction, sketches, and calculations

Table 2

Assessment: Maximum Score 100 points

Presentation of the creation (0-15):

____

Creation is creative and includes all components (0- 25): ______

Paperwork is accurate and thorough (0 – 25):

Quality of work (0 – 15):

Evidence of preparation (0 – 10):

______

Project is turned in on time (0 – 10):

Total score:

Did you know?

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Looking for books by a particular author, on a particular topic, with a particular title? The United States Library of Congress is a great place to start your search. The website for the catalog search is very easy to use, and virtually all published books have been recorded in the Library.

Venn Diagrams and Reasoning

Jeffry L. Hirst[2]
W. Hutch Sprunt[3]
Appalachian State University
Boone, North Carolina

Venn diagrams and other logical ideas appear throughout the NCTM Principles and Standards (NCTM, 2004a) and the North Carolina Mathematics Curriculum (NCDPI, 2000). For example, Venn diagrams provide a representation of data that can be used to solve problems, as in the NCTM Representation Standards for grades 6-8 and grades 9-12. Reasoning by means of Venn diagrams helps develop skills described in the NCTM Reasoning and Proof Standards. The Discrete Mathematics section of the current North Carolina Mathematics Curriculum lists Venn diagrams in competency goals 4.01 and 4.02. In light of these references, it might be nice to know exactly what a Venn diagram is.

Consider the representation of the sets of ducks (D), birds (B), and mammals (M) shown in figure 1. This is a familiar type of drawing, and most people would call it a Venn diagram.

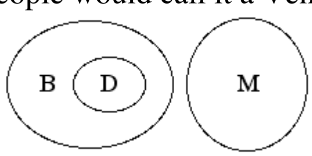

Figure 1: An Eulerian diagram showing that ducks are birds and mammals are not birds

In his book *Symbolic Logic*, John Venn (1834-1923) refers to drawings of this sort as Eulerian diagrams, distinguishing them from true Venn diagrams (Venn 1971). Venn diagrams have two defining characteristics.

1. Every possible combination of sets and complements of sets must have a compartment in the diagram.
2. Empty compartments are indicated by shading them.

This is entirely unlike Eulerian diagrams, where empty compartments are forbidden. An example of Venn diagram for the duck-bird-mammal example is shown in figure 2. Note that since all possible combinations have compartments, a Venn diagram for n sets has 2^n compartments. The diagram in figure 2 has $2^3 = 8$ compartments, counting the region outside the three circles as one compartment. The three un-shaded regions in figure 2 exactly match the regions shown in figure 1.

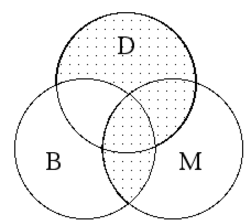

Figure 2: A Venn diagram showing that ducks are birds and mammals are not birds

Today, the term "Venn diagram" is used to refer to Eulerian diagrams, Venn diagrams, and other hybrid diagrammatic representations of sets. Consequently, a good number of Eulerian diagrams can be found in the Venn diagram materials of the NCTM (e.g. (NCTM, 2004b) and (Van Dyke, 1995)) and the Shodor Foundation (e.g. (Shodor, 2004a) and (Shodor, 2004b)).

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[2] *Jeff Hirst is Professor of Mathematics at Appalachian; he teaches a variety of math courses and does research in math logic.*
[3] *Hutch Sprunt is a Lecturer of Mathematics at Appalachian; he is interested in a variety of mathematical topics including logic and applications of mathematics in finance.*

In our duck-bird-mammal example, the Eulerian diagram is easy to construct and might be more easily read than the associated Venn diagram. Since we are familiar with the relationships between ducks, birds, and mammals, it is easy to create the Eulerian diagram in a single step. However, when the information is complicated by increasing the number of categories or intersections, the Eulerian diagram becomes harder to construct. Venn's method provides a process for recording successive increments of knowledge with shading, gradually generating the final diagram. The following example, based on a problem in Venn's monograph (Venn, 1971), illustrates this point.

(1) Every student must take Greek or Latin (or both);
(2) Anyone who takes only one of Latin and Greek must take English and French;
(3) Anyone who takes both Greek and Latin must take English or French (or both).

How many languages may a student take?

The three assumptions involve only four sets of students, those taking Greek (*G*), Latin (*L*), English (*E*), and French (*F*). However, few students can read the problem and make the leap directly to a correct Eulerian diagram. Applying Venn's method, we can address each assumption in turn. We start with an un-shaded diagram for four sets. The arrangement of shown in figure 3 contains all the necessary compartments. (The careful reader may wish to count the 2^4 =16 compartments.) On the basis of assumption (1), we conclude that any compartments that do not intersect Greek or Latin or both must be empty, and shade them as in figure 3. Since every student takes at least one language, we should also shade the region lying outside all four sets. We will skip that shading and stick to coloring inside the lines.

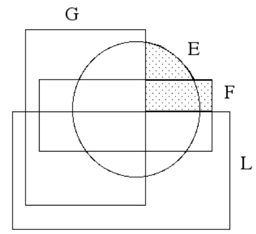

Figure 3: A Venn diagram for 4 sets

On the basis of assumptions (2) and (3), we shade additional regions of the diagram, eventually arriving at figure 4. Assumption (2) generates all the diagonal shading, and assumption (3) generates the horizontal shading. With the completed diagram, we can answer Venn's question. The center compartment (marked L4) is included in four language sets, while the surrounding compartments (marked L3) are each included in three. Thus, each student takes three or four languages.

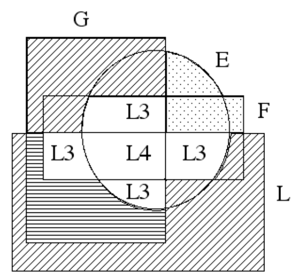

Figure 4: The Completed Diagram for Venn's Example

As the preceding example shows, relationships between categories of objects can often be formulated as statements about subsets. If *G* represents the students of Greek and *L* represents the students of Latin, then the statement "all students of Greek are students of Latin" can be written as $G \subseteq L$. By contrast, the statement "no students of Greek are students of Latin" indicates that the Greek students are a subset of the complement of the Latin students, so we write $G \subseteq \overline{L}$.

Given a list of set containments, we can deduce new facts by means of the transitive property of the subset relation. For example, if $P \subseteq Q$ and $Q \subseteq R$, then we can deduce $P \subseteq R$.

The validity of this deduction is nicely illustrated by the Eulerian diagram in figure 5. Note that if we replace formulas like $P \subseteq Q$ by implications of the form $(x \in P) \rightarrow (x \in Q)$, then the preceding deduction is an instance of the logic rule *hypothetical syllogism*, which is referred to as "transitive deduction" in the NCTM Illuminations authored by Frances Van Dyke (1995).

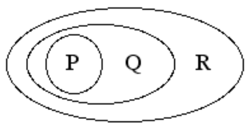

Figure 5: $P \subseteq Q$ and $Q \subseteq R$ imply $P \subseteq R$

An Eulerian diagram can also illustrate the fact that from $P \subseteq Q$ we may deduce $\bar{Q} \subseteq \bar{P}$. In figure 6, given that $P \subseteq Q$, we can see that the shaded region corresponding to $\bar{P}$ must contain all of $\bar{Q}$. When indicating complements in Eulerian diagrams, we must specify a universal set like the one represented by the rectangle in figure 6. Other variants of our complementation rule are true. For example, from $P \subseteq \bar{Q}$ we can deduce $\bar{\bar{Q}} \subseteq \bar{P}$, which is equivalent to $Q \subseteq \bar{P}$ because $\bar{\bar{Q}} = Q$. Rewriting these deductions using implications yields the logical properties of the contrapositive.

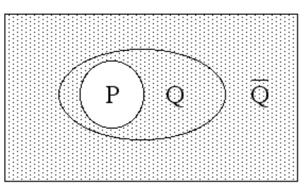

Figure 6: Illustrating complements of sets

By applying these translation and deduction techniques, we can solve the logical problems that Lewis Carroll refers to as *sorites*. (Pronunciation: suh-RYE-teez. In general, a sorites is a deduction from a heap of implications; the Greek word for heap is σωρο′ς=*soros*.) Here is a list of hypotheses provided in Book VIII, §9 (Carroll, 1958):

(1) All babies are illogical;
(2) No person is despised who can manage crocodiles;
(3) All illogical persons are despised.

We assign set names to the following groups of people:

B = the set of babies;
D = the set of despised people;
C = the set of people who can manage crocodiles;
I = the set of illogical people.

Then (1) translates as $B \subseteq I$, (2) translates as $D \subseteq \bar{C}$, and (3) translates as $I \subseteq D$. Lining up all of our translations yields

$$B \subseteq I \subseteq D \subseteq \bar{C},$$

so by transitivity we deduce $B \subseteq \bar{C}$. This translates as "no babies can manage crocodiles," matching Carroll's solution. Applying the complementation rule yields the equivalent correct solution $C \subseteq \bar{B}$, which translates as "nobody that can manage crocodiles is a baby." Other facts could be correctly deduced, for example $B \subseteq D$ (all babies are despised) or $I \subseteq \bar{D}$ (no illogical person can manage a crocodile), but these conclusions don't use all of the hypotheses for the puzzle. Of course, while these deductions are correct, the truth of the conclusions depends on the truth of the hypotheses set forth by Carroll.

Given the relationship

$$B \subseteq I \subseteq D \subseteq \bar{C},$$

it is easy to draw the Eulerian diagram shown in figure 7. However, it seems more fruitful to apply Venn or Eulerian diagrams to justify the deduction techniques than to use the diagrams directly to solve a particular sorites problem.

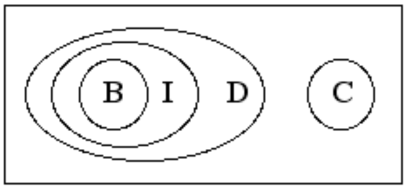

Figure 7: An Eulerian diagram for $B \subseteq I \subseteq D \subseteq \overline{C}$

Some of Carroll's sorites problems require the use of the contrapositive. For example, consider the hypotheses:

(1) There are no pencils of mine in this box;
(2) No sugar plums of mine are cigars;
(3) The whole of my property that is not in this box consists of cigars.

Using "the whole of my property" as a universal set, we assign set names as follows:

P = (my) pencils;
B = things in this box;
S = (my) sugarplums;
C = (my) cigars.

Then (1) translates as $P \subseteq \overline{B}$, (2) translates as $S \subseteq \overline{C}$, and (3) translates as $\overline{B} \subseteq C$. Now (1) and (3) match nicely, yielding

$$P \subseteq \overline{B} \subseteq C .$$

From $S \subseteq \overline{C}$, we can derive the contrapositive $C \subseteq \overline{S}$, and append it to our list to get

$$P \subseteq \overline{B} \subseteq C \subseteq \overline{S} .$$

By transitivity, we conclude that $P \subseteq \overline{S}$, that is, no pencils of mine are sugarplums. Carroll concurs, although his solution method is somewhat different.

Although we have not used a diagram to solve this sorites, we did use one to justify the contraposition rule applied in the solution. In general Eulerian diagrams, Venn diagrams, and their hybrids are useful tools for representing reasoning and solving logic problems.

Following this article is a worksheet of additional problems on Eulerian diagrams, Venn diagrams, and sorites.

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Shodor Education Foundation. (2004a). *Venn Diagrams* [On-line]. Available: http://www.shodor.org/interactivate/activities/vdiagram/.

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Van Dyke, F. (1995). A Visual Approach to Deductive Reasoning. *The Mathematics Teacher*, 8[6], 481-487.

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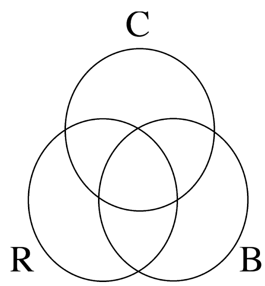
Activity Sheet: Venn Diagrams and *Sorites*

1. For part (i), use shading to complete the Venn diagram for the given sets. For part (ii), draw an Eulerian diagram for the sets.

(a) Suppose that the universe consists of all people.

C: Residents of Boone, NC.
R: Residents of North Carolina.
B: People born in North Carolina.

(i)

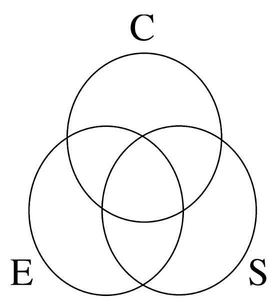


(ii)

(b) Suppose that the universe consists of geometric figures.

C: Circles.
E: Ellipses.
S: Squares.

(i)

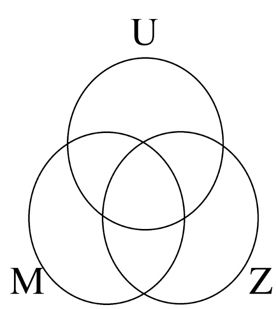


(ii)

(c) Suppose that the universe consists of animals.

U: Bears.
M: Mammals.
Z: Animals living in zoos.

(i)



(ii)

2. Use a Venn diagram to solve the following problem. Fritz attends a small school with a football team, a marching band, a choir, and no other activities. Suppose the following are true.

- Everyone is in more than one activity.
- No one is in all three activities.
- No football player is in the choir.

If Fritz is not in the choir, then what activities does he do?

3. Solve the following sorites problems by converting the statements to set containments. A correct answer will use every statement:

(a) Every crayon in this box is brightly colored. No brightly colored crayon is gray.

(b) Elephants refuse cookies. Everyone in my kitchen has a cookie.

(c) Every hardbound book is a textbook. No textbook is printed in New York. Every interesting book is printed in New York.

Outstanding Teachers 2004

To underscore the importance of mathematics instruction in the elementary classroom, each year NCCTM recognizes teachers who make mathematics exciting and who nurture their students' enthusiasm. By involving them in mathematics fairs, projects, and competitions, these teachers motivate children to excel in mathematics.

Principals of North Carolina schools with any combination of grades kindergarten through five to nominate the teacher who does the most effective job teaching mathematics in their schools. From those nominated, each LEA is asked to select one teacher who represents the best in mathematics teaching from the entire system. The teacher selected from each LEA received one year's membership in the NCCTM, was recognized at the annual meeting in Greensboro on October 8th, and received a special memento of the occasion. This year's awardees are:

Christine Kreider, Alamance-Burlington
Terri Ferguson, Alexander County
Diane Fisher-Cauble, American Renaissance Middle
Melody J. Harris, Anson County
Carmen Wilson, Ashe County
Gina Allred, Asheboro City
Betty Green, Beaufort County
Eva White, Bertie County
Cindy Gulledge, Brunswick County
Nikki Costello, Buncombe County
Tyra W. Jones, Burke County
Heather Raymond, Cabarrus County
Janet W. Fore, Caldwell County
Brenda Nash, Camden County
Holly Smith, Carteret County
Jeanine Lynch, Catawba County
Gretchen Buher, Chapel Hill-Carrboro
Heather LaJoie, Charlotte-Mecklenburg Schools
Amy M. Beavers, Chatham County
DavAnn Hubbard, Cherokee County
Cathy Stagis, Craven County
Carol T. Lloyd, Cumberland County
Carol M. Collins, Davidson County
Kathy Pegram, Davie County
Kendall W. Davis, Edgecombe County
Gloria Forehand, Edenton-Chowan Schools
Donna Jomp, Elizabeth City/Pasquotank Schools
Diane E. Renck, Franklin County
Theresa Holmes, Gaston County
Peggy J. Walston, Gates County
Joyce Perkins, Graham County
Sambra Desrosiers, Granville County
Susan Marshall, Guilford County
Rebecca Blackburn, Harnett County
Charles Howard, Haywood County
Lois Rhodes, Henderson County
Tommy Jacobs, Hoke County
Gina Credle, Hyde County
Ellyn Johnson, Iredell-Statesville Schools
Charles W. Bolognia, Jackson County
Pascal T. Mubenga, Johnston County
Debra Batts, Jones County
Judith A. Meir, Kannapolis City
Sanjana Sharma, Lee County
Jerri Sue Staton, Lincoln County
June Fletcher, Macon County
Fannie Howell, Martin County
Robin Greene, McDowell County
Samuel C. Martin, Montgomery County
Sharon Markofski, Mooresville Graded District
Denise Helms, Nash-Rocky Mount Schools
Sharon Williams, New Hanover County
Julia Styers, Newton-Conover City
Alison R. Miller, Onslow County
Merry S. Sadler, Pamlico County
James Timmons, Pender County
Tisha Newton Love, Pitt County
Geoffrey A. Lucia, Providence Day School
Lewis E. Southern, Randolph County
Nancy B. Porter, Richmond County
Connie Locklear, Robeson County
Todd Moore, Rockingham County
Cindy D. Safrit, Rowan-Salisbury
Michael Johnson, Rutherford County
Sharon Lewis, Sampson County
Elizabeth Williams, Scotland County
Thyra Drye, Stanly County
Rebecca Patterson, Stokes County
Rhonda Goins, Surry County
Jennie Yearick, Union County
Joan Cooper, Vance Charter School
Julie Kolb, Wake County
Karen L. Fleming, Warren County
Charlene Evans, Washington Schools
Stephen Schmal, Watauga County
Robin Re, Wayne County
Rebecca Stephens, Whiteville City

Ramona Hemric, Wilkes County
Deborah Deans, Wilson County
Susan W. Yount, Winston-Salem/Forsyth
Scott C. Johnson, Yadkin County
Angel Willis, Yancey County

North Carolina Zoological Society

Mark MacAllister[4]
North Carolina Zoological Society
Pittsboro, North Carolina

The North Carolina Zoological Society is a private, non-profit organization that supports the North Carolina Zoological Park in Asheboro. The Society has obtained funding to build an Intern and Education Center at the Zoo. This new building will allow the society to provide housing and dining facilities for interns working at the Zoo, as well as to host K-12 teachers and other educators for staff development workshops, training sessions, and so on. The Center will also provide meeting space, a wireless computer lab, and other teaching and learning resources.

One of the many goals for the Center is to develop and deliver a selection of staff development opportunities for K-12 teachers. In the past, the Zoo has offered a variety of workshops. Some were experiences focused on the use of the "Field Trip Earth" conservation education website, which can be accessed online at http://www.fieldtripearth.org. Teachers have also come to Asheboro to learn how to integrate digital video resources into their classrooms, while others have learned techniques for collecting data in the field. These experiences have attracted teachers from all of the academic disciplines and from all grade levels.

In order for the Zoological Society to develop the most successful curriculum possible, they need to assess teachers' needs. They must know, essentially, what teachers need to learn, how teachers want to learn it, and when teachers can find time to learn it. This needs assessment will guide the society as they design programs for eventual implementation in the Center.

If you are a K-12 teacher and are interested in completing such a needs assessment, please complete a brief survey available online, via a North Carolina Zoological Society website. The assessment will not be available until late January 2005.

NCTM 2005

The National Council of Teachers of Mathematics 2005 Annual Meeting and Exposition will be in Anaheim, California, Wednesday, April 6 through Saturday, April 9, at the Anaheim Convention Center, the Anaheim Marriott Hotel, and the Hilton Anaheim Hotel. The conference theme is *Embracing Mathematical Diversity*. < www.nctm.org/meetings/anaheim/>

[4] *Mark MacAllister is the coordinator of On-Line Learning Projects at the North Carolina Zoological Society. He can be contacted at 919-545-3068 or online at http://ical.mac.com/markmacallister/home32office.*

NCCTM Trust Fund Scholarship

North Carolina Council of Teachers of Mathematics

$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
P.O. Box 121
Sugar Grove, NC 28679

Direct inquiries to:
Bill Paul, Chairperson
Phone: (828) 297-3839
E-mail: bnpaul@skybest.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.

Math in the Middle

An NCCTM Minigrant: The Geometry of Fashion

Patty Schram
Aycock Middle School
Greensboro, North Carolina

What do NCCTM, shopping, and eleven-year-old math students have in common? Why it must be an NCCTM Mini-Grant! Students at Aycock Middle School in Greensboro, NC spent a month designing, constructing, and running their own scale-model clothing stores. They had to adhere to strict regulations, budgets, and the ever-changing influences upon sales. Inspired by a newspaper article about how geometry is used to design mall stores, I designed a reality-based math unit using active student engagement, a multicultural approach, and linked it all to the North Carolina Standard Course of Study. My teammates expanded this fun unit to include Science and Language Arts components as well, deepening this rich mathematical experience. Here are their tasks.

Step one: Students selected a client at random, for which they designed a mall-type store with specific geometric requirements. They drew scaled blueprints using metric conversions. They used a rubric to assist them in the design, including fire safety and handicapped codes. Upon completion of the design on centimeter graph paper, they submitted their design to the Mall Approval Board for approval.

Step two: Students surveyed and graphed results of possible items to sell in their stores. They created the sales pitch, logo, and advertising campaign using persuasive writing skills. They analyzed competitors' advertising and made constant adjustments and submitted their ideas to the clients for approval.

Step three: After the designer received his or her certificate of approval and the client's approval, they proceeded to the building stage under the direction of the Mall Construction Foreman. The clients' stores came to life created by cardboard, felt, pipe cleaners, paint, markers, and fabric. Fire code as well as handicapped codes were followed. A building inspector spoke to the students during construction. The attached rubric guided students in the construction stage.

Step four: After students earned their certificate from the Mall Construction Foreman, they began illuminating their stores using battery lights. All stores were required to have a lighted sign in the front of the store. All safety, electrical, handicapped inspections needed to be cleared before the owners receive their Certificate of Occupancy.

Step five: Three anchor stores were built for the left, right, and center of the mall. A lottery of clients' stores was drawn to hold the position closest to the anchor store to insure the greatest foot traffic and higher revenues. The three floors of the mall were assembled in the back of the classroom. A large red ribbon was draped across the mall waiting for the GRAND OPENING.

Step six: Students were given a monthly budget for their stores along with a list of credits and debits to create this budget. They were required to produce this budget with two random entries, such as 10% more revenue due to high foot traffic, 7% increase due to holiday traffic, 3% decrease due to shoplifting, or .5% decrease in revenues due to increased sales taxes. All entries were produced in percent, decimal, and fraction forms. (They loved extra holiday sales revenues, but their budgets were then asked to pay extra salaries for increased hours worked. That was a mini Math lesson right there.)

PHOTO HERE

The Completed Fashion Mall

Step seven: Students created a three sided project board containing their original blueprints, samples of building materials, samples of their advertising campaign, graphs of their peer surveys, and one month's budget with all of the percents, decimal, and fraction equivalents. They also produced the recalculated monthly amount including their special adjustments.

Step eight: Parents, TV Media, and School Board Members were invited to the nighttime mall opening including ribbon cutting ceremony, a lighting ceremony, and presentations of budgets by students. Power Point advertising presentations were presented on the smart board.

Each step of the way, students used rubrics as a guide to success. Authentic assessment graded each step and "chunked" the assignment into manageable pieces of the entire project. This Mini-Grant helped to buy all of the supplies to create this magical mathematical mall. It was a highlight of our school year that would not have been possible without the help from NCCTM.

Mini-Grants from NCCTM

The mini-grant program is designed to promote excellence in mathematics education. 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. A total of $6,000 will be awarded in each of the three NCCTM regions. Applications will be accepted only from persons who are NCCTM members as of 1 September 2004.

Completed applications must be received by 15 September 2004 to be considered. For more information and submission guidelines, contact Phyllis W. Johnson by email at <pwjohnson210@earthlink.net> or by phone at 252-752-1796.

Activity Sheet: Florence Nightingale's Polar Area Diagrams

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. 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 that serve as the basis for this nomination (a separate attached document may be used):

Additional information that would be of value to the selection committee (a separate attached document may be used):

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

Closed-Form, Recursion, and Mind-Reading: Defining Sequences by Various Means

Harold Reiter[5]
University of North Carolina at Charlotte
Charlotte, North Carolina

My friend said to me, 'I'm thinking of a sequence of positive integers the first four terms of which are

Stone, N. J. A. (2004). *On-Line Encyclopedia of Integer Sequences* [On-line]. Available: http: //www.research.att.com/~njas/sequences/.

[5] *Dr. Reiter is Associate Professor of Mathematics and has just completed a term as President of the national mathematics honor society, Mu Alpha Theta.*

NCCTM FALL CONFERENCE

34th Annual Conference of the
North Carolina Teachers of Mathematics

Transitioning into the New Mathematics Curriculum

October 7 & 8, 2004

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

Registration Fees: $55 ($45 for members, $5 for students)

Registration: Forms available at www.ncctm.org or at the conference Wednesday evening, or Thursday and Friday all day.

Hope to see you there!

Awards

The North Carolina Council of Teachers of Mathematics
Rankin Award – 2004
Randy Harter

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???????

Randy Harter, Mathematics Specialist in Buncombe County since 1987, received the 2004 W. W. Rankin Award for Excellence in Mathematics Education presented by the North Carolina Council of Teachers of Mathematics (NCCTM).

The Award was made during the 34th Annual State Mathematics Conference held at Koury Convention Center in Greensboro, NC on October 7-8, 2004. The Award is given in recognition of outstanding contributions to mathematics education in North Carolina. First presented in 1974, the Award is named for Dr. W. W. Rankin, formerly of Duke University, who was instrumental in organizing annual mathematics conferences for teachers and who was the first to develop mathematics institutes in North Carolina.

Mr. Harter was cited for his prolific contributions to mathematics education in Buncombe County and the state. His understanding of mathematics and passionate commitment to quality instruction is well known and admired throughout the mathematics education community. His ability to acquire funding for staff development and persuade teachers to grow professionally is phenomenal.

Mr. Harter's passion for high quality mathematics education has not only led Buncombe County in establishing a vision of high quality teaching and learning opportunities, but has also affected neighboring school systems as well as the entire state of North Carolina. Mr. Harter has served as a member of numerous state committees and various leadership positions in NCCTM. He has served as President and as a Vice President of NC Council of Teachers of Mathematics, as well as State Director for the American Mathematics Com-petitions.

Awards

The North Carolina Council of Teachers of Mathematics Innovator Award Winner – 2004 Jeane Joyner

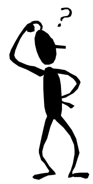
Phillip Johnson
Appalachian State University
Boone, North Carolina

Since 1994, the North Carolina Council of Teachers of Mathematics has recognized innovative contributions to the organization and to mathematics education in the state with the Innovator Award. The stated purpose of the award is to recognize and reward individuals or groups who have made an outstanding or noteworthy contribution to mathematics education and/or NCCTM by having founded, initiated, pioneered, or developed some program in mathematics education of service to a geographical region of the state or the entire state.

This year's winner of the Innovator Award is Jeane Joyner, who has worked in education for more than 40 years and in mathematics education for more than 25 years. She has had a profound influence on elementary school mathematics, first as a teacher and then in the State Department of Public Instruction. Now retired, she remains active in NCCTM and is the 2004-2005 president-elect. She is also a principal investigator on National Science Foundation projects and teaches courses at Meredith College. Jeane has previously been recognized with numerous awards, noteworthy being the Association of State Supervisors' Outstanding Mathematics Educators' Award and NCCTM's Rankin Award. She regularly presents at NCTM and NCCTM meetings and has been instrumental in influencing others to become leaders in mathematics education. She was the writing group chair of the NCTM *Principles and Standards* for grades preK-2.

About 1989, Jeane started to engineer a change in the way elementary mathematics is taught in North Carolina through a National Science Foundation project known as the Teaching Excellence and Mathematics project (TEAM). Jeane and Gwen Clay of Meredith College wrote the original grant proposal. This project has built strong mathematics leaders at the elementary level. Thirty five elementary teams of two teachers from several regions across the state were brought together and taught by some of the best mathematics educators from across the nation. The results of teaching mathematics to elementary teachers and giving them purpose for what they taught have been far reaching. The TEAM teachers were the first to produce what is now known as the "North Carolina Strategies for Instruction in Mathematics." These manuals have grown from a small handbook to one with three sections, including assessment strategies and questions. TEAM also produced a problem-solving deck of cards and other materials to assist teachers in the teaching and learning of mathematics. Furthermore, they were key members of the teams of teachers who helped to revise the curriculum in the 1990's. They have also presented countless workshops at the district, regional, state, and national levels. The first TEAM project officially lasted three years, but the project continues to thrive, a result always desired by grantors but not always achieved. Under Jeane's leadership, the TEAM members wrote the original strategies books for K-5 and developed valuable resources for teachers. Many of the present and past NCCTM Board members were on the original TEAM project and several of them have presented repeatedly at state and regional conferences.

Now there is a TEAM II project, again funded by NSF. The second NSF grant started in 2000 and is for a five-year period. Again Jeane, with help from Gwen Clay, has brought 30 teams of two from a variety of districts across the state and is developing mathematics leaders, using national mathematics leaders and the "old" TEAM members as presenters and advisors. This past summer, the new TEAM II developed math matters workshops on the revised mathematics curriculum and presented them all over the state. The evaluations of the workshops have been exceptionally positive. The influence of the two TEAM projects promises to continue to have a profound impact on mathematics education for years to come.

Problems to Ponder 

Spring 2005 Problems

Gregory S. Rhoads
Appalachian State University
Boone, North Carolina

Grades K–2 Peter asked John how many pieces of fruit he had. John said the numbers 4, 8, 5, and 2, and then he said the largest of those numbers was how many apples and the smallest of those numbers was how many oranges he had. How many apples and oranges total did John have?

Grades 3–5 How many different whole numbers can be made with the digits 1, 6, and 9? The whole number may have 1, 2, or 3 digits in it, but a digit may not be repeated in any number.

Grades 6–8 A container holds 48 marbles of various colors (yellow, red, blue, and white). There are twice as many yellow as red marbles and twice as many blue as white marbles. There are also six more white marbles than red marbles. What is the probability of randomly drawing a white marble out of the container?

Grades 9–12 Find the area of the region satisfying both $y \geq |x|$ and $x^2 + y^2 \leq 1$.

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 wish to 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 15 March 2005 to:

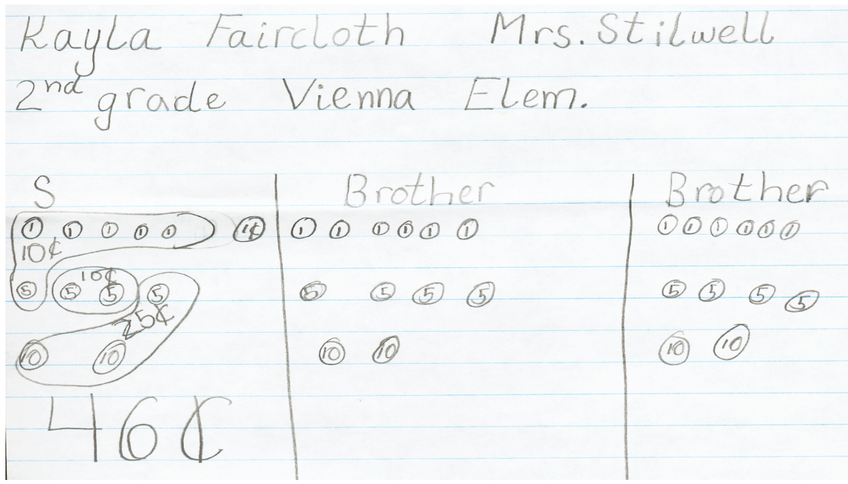
Problems to Ponder
c/o Dr. Greg Rhoads
Dept. of Mathematical Sciences
Appalachian State University
Boone, NC 28608

As these problems are intended to stimulate independent thinking, it is expected that a submitted solution indicates 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 Fall 2004 Issue

Grades K-2

Sally's mother is giving Sally and her two brothers their weekly allowance. Sally's mother will divide 18 pennies, 12 nickels, and 6 dimes between the 3 children. If each child is to receive the same amount, what is the total amount of Sally's allowance?

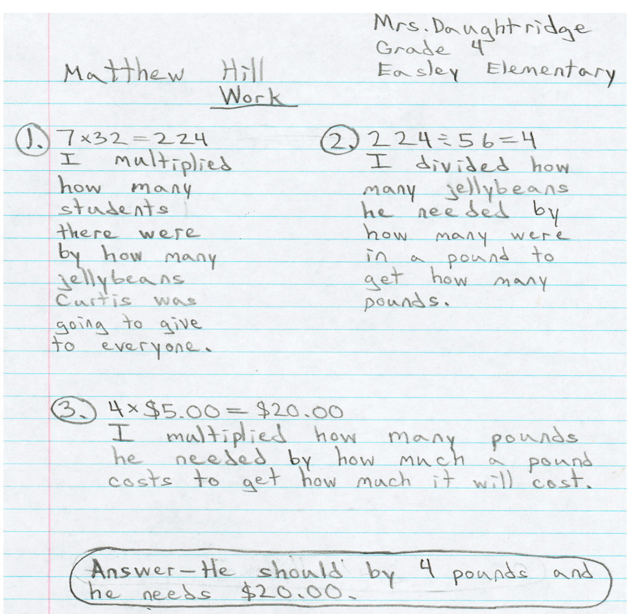


Solution: Kayla Faircloth, 2nd grade, Vienna Elementary (Teacher: Mrs. Stilwell)

Correct Solutions were received by Samantha Youngblood of **Avery's Creek Elementary**, Joshua Jacobs of **Bethesda Elementary**, Mari Joe M. Sanqui of **Hardin Park Elementary**, Rhiana Balmer, Caitlin Drake, Jonathan Jackson, Kayla Krender, Stephen Pearsall, Taylor Rogister, Shae Scott of **Moyock Elementary**, Emma Davis, Kayla Faircloth, John Henry Jackson, Caroline Marshall, Logan Welch of **Vienna Elementary**, James Michael Sapp of **W. D. Williams Elementary.**

Grades 3-5

Curtis is making bags of jellybeans for the other students in his class. Jellybeans cost $5.00 per pound and there are approximately 56 jellybeans in a pound. If Curtis wants to put 7 jellybeans in a bag for each student, and there are 32 other students in his class, how many pounds of jellybeans should he buy and how much money will he need?



Solution: Matthew Hill, 4th grade, Easley Elementary (Teacher: Mrs. Daughtridge)

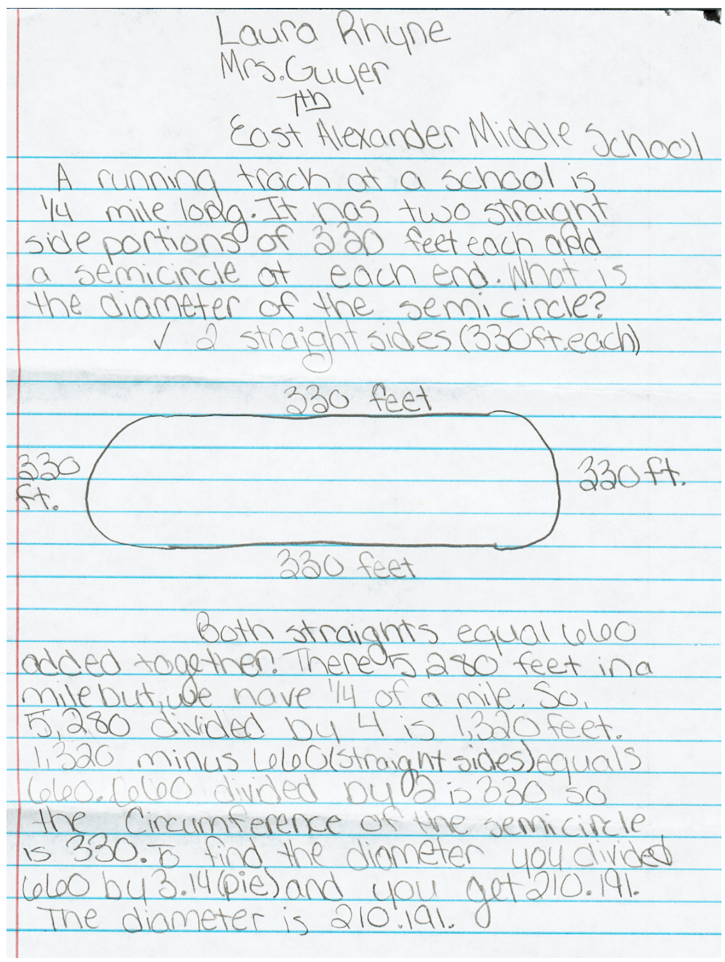
Correct Solutions were received by Josh Allen, Seth Baker, Douglas Beckner, Tiffany Borden, Kelsey Byerly, Meagan Eakes, Victoria Hamby, Morgan, Charlie Holt, Saad Khan, Mary McDonald, Kelly McNeil, Gabrielle Merritt, Mary Kate Payne, Maggie Wilkinson of **Burlington Day**, Dustin Atkins, Ian Boone, Martina Demick, Brandy Duncan, Chelsea Farmer, Keely Griffith, Brandi Hensley, Danielle Hughes, Dillon Laws, Emily Penland, Brooke Phillips, Molly Riddle, Melanie Riddle, Athena Theodorides, C. J. Wilson, Tyler Worden, William Caleb Young of **Burnsville Elementary,**, Alison Andrews, Rebecca Clark, Taylor Ellis, Caralyn Evans, Ben Evans, Matthew Hill, Alli Kenlon, Kellie Levine, Jake

Miles, Evan Murray, Meaghan O'Mary, Lawson Osteen, Erin Patrick, Jason Scoggins, Scott Smith, Cameron Snow, Julie Upchurch of **Easley Elementary**, Jacqueline Fisher, Grace Yook of **Florence Elementary**, Katie Beeman, Emily Jones, Luke Joyner, Michael Sutton of **Red Oak Elementary**, Olivia Boddie, Emma Anne Park of **Rocky Mount Academy**, Brooke Anderson, Will Beck, Alex Bernatzky, Cody Brooks, MacKenzie Brown, Coleman Bumgardner, Michael Burke, Chris Collichio, Nathalie Dail, Tucker Dowell, Jennifer Frix, McKenzie Mull, Cody O'Brien, Sara Perrella, Cory Petersen, Casey Read, Jeff Rikard, Joey Royko, Darin Salter, Beth Thomas, Jared Tulker, Ross Wilhite, Amber Sue Workman of **St. James Elementary**, Emily Kimble, Gerri Luther, Abril Reyes, John Luke Sapp, Sarah Watson of **W. D. Williams Elementary.**

Grades 6-8

A running track at a school is 1/4 mile long. It has two straight side portions of 330 feet each and a semicircle at each end. What is the diameter of the semi-circle?

Solution: Laura Rhyne, 7th grade, East Alexander Middle School (teacher: Mrs. Guyer)



Laura Rhyne
Mrs. Guyer
7th
East Alexander Middle School

A running track at a school is 1/4 mile long. It has two straight side portions of 330 feet each and a semicircle at each end. What is the diameter of the semicircle?
✓ 2 straight sides (330 ft. each)

330 feet
330 ft.
330 ft.
330 feet

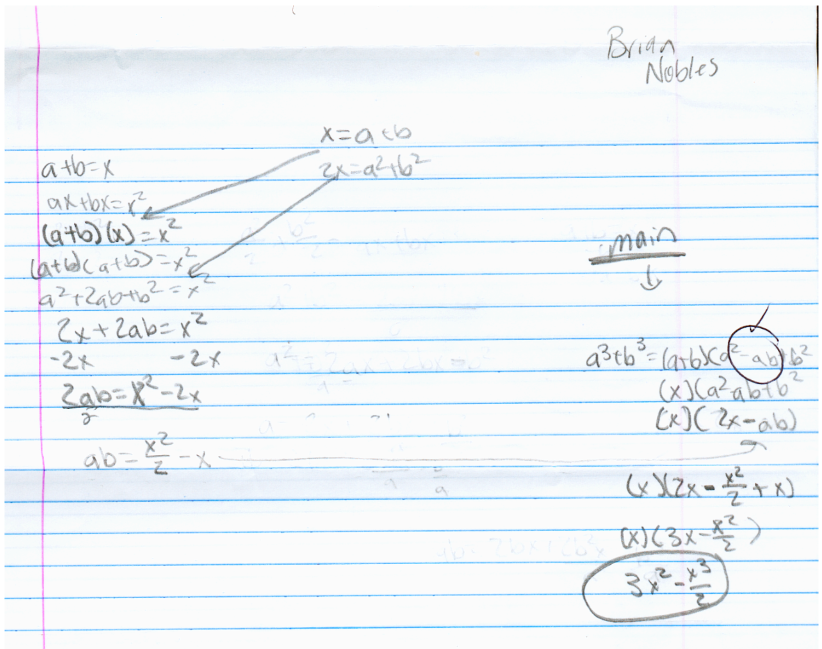
Both straights equal 660 added together. There's 5,280 feet in a mile but we have 1/4 of a mile. So, 5,280 divided by 4 is 1,320 feet. 1,320 minus 660 (straight sides) equals 660. 660 divided by 2 is 330 so the Circumference of the semicircle is 330. To find the diameter you divided 660 by 3.14 (pie) and you got 210.191. The diameter is 210.191.

Correct Solutions were received by Kenny Asmuth, Kari Johnson, Scott McWhirter, Jonathan Ray, Gregory Sneathen of **Belmont Middle,** Benjamin Bell, Taylor Dunn, David Guarino, Parker Hayes, Preston Hill, Spencer Hill, Andrew Hill, Allison Leamon, Evelyn Norton, Michael Page, Rachel Patton, William Pharr, Susan Rich, David Robinson, Aaron Schimmmel, Abbie Storch, Annie Swern, Timothy Upper, Emily Williams, Noah Wolff, Sam Young of **Caldwell Academy**, Jeff Berry, Courtney Braziel, Hunter Bright, Lindsey Bull, Taylor Carawan, Courtnie Chong, Christopher Conner, Aaron Durham, Samantha Faber, Joshua Goninan, Molly Gorczyca, Dillon Harrison, Kayla LaBarge, Kevin Lee, Jesse Martin, Sydney McCauley, Olivia Pugh, Josh Smaltz, Cole Sweeney, Berkley Tate, Miranda Van Driesen of **Currituck Middle**, Sarah Elizabeth Christian, Jamie Cook, Kristen Easters, Emily Jones, Amy Kalinowski, Brittany McCarthy, Danielle Moloney, Adam Mumford, Dylan Ray, Kelen Townsend, Adam Vos of **E. B. Aycock Middle**, Chassidy Campbell, Ryan Hargrave, Melinda Justice, Shana McClain, Laura Rhyne, Garrison Sigmon of **East Alexander Middle**, Collin Hobbs of **East Wayne Middle**, Ayana Littlejohn, Erin McMurtrie of **Southeast Middle**, Austin Allen, Jeanna Coleman, Athina Conklin, Nikki Cooley, Jefferson Ellington, Lucy Goodwin-Johansson, Caleb Haselton, Jay Lee, Sam McGowen, Brandon Norris, Keegan Pace, Sapa Patel, Aric Pope, Helen Powell of **Turrentine Middle.**

Grades 9-12

If $a+b=x$ *and* $a^2+b^2=2x$*, then write* a^3+b^3 *as a polynomial in* x*.*

Solution: Brian Nobles, 10th grade, New Bern High School (Teacher: Ms. Odynski).



A Correct Solution was received by Brian Nobles of **New Bern High.**

Editor's Note: *This problem was not easy. As Brian did, you need to find* ab *as a polynomial in* x*, and then you have everything you need when you cube* $(a+b)$*.*

Discovering Mathematics

Laura Davis[6]
Southeastern Community College
Whiteville, North Carolina

Do you remember the excitement you felt the

Ormrod, J. (1995). Educational psychology: Principles and applications. Upper Saddle River, NJ:Prentice Hall.

The LearnNC Education Glossary

Looking for information on education topics, like Bloom's taxonomy mentioned in the article above? Check out the LearnNC site's searchable glossary. <vote.learn.unc.edu.glossary>

[6] *Laura Davis is a mathematics instructor at Southeastern Community College in Whiteville, North Carolina. This article is based on a series of professional development workshops she has conducted through the years. Ms. Davis has experience teaching mathematics at grades five through college.*

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

2004 NCCTM State Math Fair Winners

Primary and Elementary Divisions

Congratulations to the students for jobs well done! Watch for details on the 2005 Regional and State Math Fairs.

Primary Division

Grades K–2

1st Place
Nicholas Kowalski
It's Lunch Time: Let's 'Half' a Sandwich
South Greenville Elementary School
Greenville, NC

2nd Place
Cole Rassin and Austin Miller
When Does 1+1=10? The Binary System
Dr. John Codington Elementary School
Wilmington, NC

3rd Place
Ethan Walters
Which AFC Football Team Won the Most Games in 2003?
Dr. John Codington Elementary School
Wilmington, NC

Honorable Mentions

Ashlynn Eddy and Lyndsay Wilcox
Taste vs Kernels
Meadowlark Elementary School
Winston-Salem, NC

Frederick Micheli
Ratios
Rocky River Elementary School
Concord, NC

Elementary Division

Grades 3–5

1st Place:
Jordan Clark-Brown
How Much Does the Davidson Elementary Morning Car Pool Line Cost?
Davidson Elementary School
Davidson, NC

2nd Place:
Le Khoi Chau
How Would You Invest for Higher Education?
Lincoln Heights Elementary School
Charlotte, NC

3rd Place:
Katie Scheuerle and Morgan McMahon
Step Up to the Beat
Mount Mourne Elementary School
Mooresville, NC

Honorable Mentions

Tyler Reinhold
More Shots For Your Money
D.F. Walker Elementary School
Edenton, NC

Maggie Pendergrass
Disney or Bust
Dr. John Codington Elementary School
Wilmington, NC

Hollis Elmore
Coins to Fly By
D.F. Walker Elementary School
Edenton, NC

Molly O'Brien and Dana Guthrie
Life As a Sponge
White Oak Elementary School
Cape Carteret, NC

2004 NCCTM State Math Fair Winners

Middle School and High School Divisions

Congratulations to the students for jobs well done! Watch for details on the 2005 Regional and State Math Fairs.

Middle School Division

Grades 6–8

1st Place
Rebecca Gregory
Swing, Swing
Camden Middle School
Camden, NC

2nd Place
Bobby Schultz
Trapped in Motion
Magellan Charter School
Raleigh, NC

3rd Place
Leah Stephens
Knot Theory and Mathematical Knots
Aycock Middle School
Greensboro, NC

Honorable Mentions

Caitlin Byrd and Alissa Kalinowski
Overtime Math
E.B. Aycock Middle School
Greenville, NC

Chris Wong
Origami
Aycock Middle School
Greensboro, NC

Ben Yuen
Making Sense of Dollars
Brawley Middle School
Mooresville, NC

High School Division

Grades 9–12

1st Place
Kim Canuette
Folding in a Little Math
North Duplin High School, NC
Calypso, NC

2nd Place
Chris Hutchinson and Katie Montgomery
Mass of Saturn
Cape Fear High School
Fayetteville, NC

Honorable Mention

Candace Matthews and Dana Jo Outlaw
Phi: One H of a Lot Cooler Than Pi.
Hertford County High School
Ahoskie, NC

NCTM 2005

The National Council of Teachers of Mathematics 2005 Annual Meeting and Exposition will be in Anaheim, California, Wednesday, April 6 through Saturday, April 9, at the Anaheim Convention Center, the Anaheim Marriott Hotel, and the Hilton Anaheim Hotel. The conference theme is *Embracing Mathematical Diversity*.

2004 NCCTM Math Logo Contest Winners

From a field of approximately 2,000 entries, twelve logos submitted by the following students were judged to be the winners in the 2004 Logo Contest.

State Winner
Joshua Arnold, Grade 6
Weddington Middle School
Waxhaw, NC
Teacher: Ms. Stevens

Eastern Regional Finalists

Jeffrey Smitherman, Grade 1
Rocky Mount Academy
Zebulon, NC
Teacher: Ms. Ann Cobb

Ethan Mairs, Grade 8
Williston Middle School
Wilmington, NC
Teacher: Ms. Katie Woodard

John Thomas Rains, Grade 5
Dublin Primary School
Elizabethtown, NC
Teacher: Mrs. Penny Guyton

Jacob Jasbolka, Grade 12
Sanderson High School
Raleigh, NC
Teacher: Ms. June Blackwell

Central Regional Finalists

Kathy Chan, Grade 1
Glendale Acres Elementary
Fayetteville, NC
Teacher: Mrs. Bender

Sarah Attayek, Grade 8
Aycock Middle School
Oak Ridge, NC
Teacher: Ms. Carolyn Warren

Meredith Mock, Grade 5
Vienna Elementary School
Pfafftown, NC
Teacher: Shane O'Neal

Katy Purgason, Grade 10
Caldwell Academy
Greeensboro, NC
Teacher: Ms. Lynn Church

Western Regional Finalists

Parker Hills, Grade 5
Catawba Spring Elementary School
Stanly, NC
Teacher: Ms. Pat Freeman

Joshua Arnold, Grade 6
Weddington Middle School
Waxhaw, NC
Teacher: Ms. Stevens

Jake Nelson, Grade 5
North Brook Elementary School
Vale, NC
Teacher: Ms. Denise Smith

Sara Lake, Grade 9
Independence High School
Charlotte, NC
Teacher: Ms. Carol Huss

2005 NCCTM Math Logo Contest

The Celebrate Mathematics Committee will once again sponsor a Math Logo Contest. The winning logo will be the mathematics logo for NCCTM for the 2005-2006 school year. This logo will be used on a poster to promote interest in mathematics and as the basic design for NCCTM's 2005 T-shirt.

A professional graphic artist will prepare the final art of the winning entry for printing. Though the illustration is an important part of the logo, entries are judged on idea or concept conveyed. Use of copyrighted work (clip art, cartoon characters, etc.) will automatically disqualify the entry. The words of the slogan should not be on top of or touch the design.

Duplicate the following label and include on the back of each entry. Entries submitted with incomplete information may be disqualified.

Student's Name:____ Grade:______

Home Address:____

____

School Name:____ LEA:_______

School Address:____

____

Teacher's Name:____

*NCCTM Region: Eastern Central Western
(circle one) *See NCCTM Regional Map Below

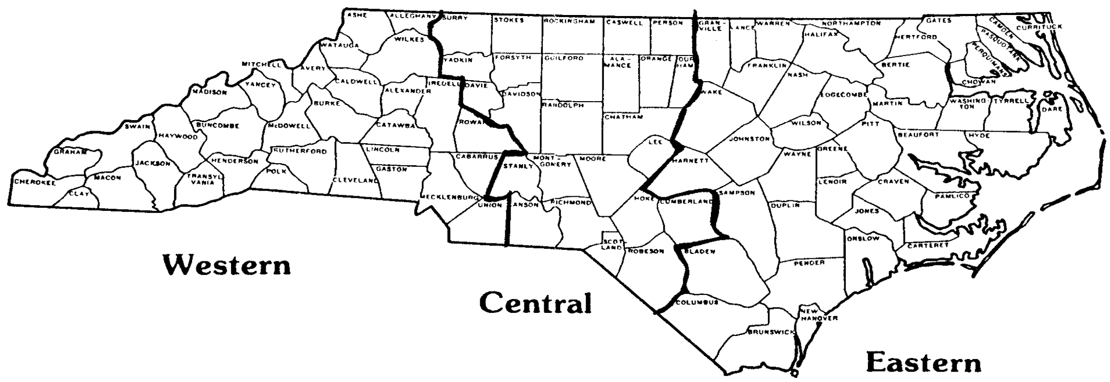
Please submit the entries on **8 1/2 x 11 paper in black ink or black marker only.**

Entries must be postmarked by 1 March 2005

Mail to: Rebecca Caison, MATH LOGO CONTEST,
101 E. Laramie Drive, Mebane, NC 27302

North Carolina Council of Teachers of Mathematics

NCCTM Regional Structure



NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS

MEMBERSHIP – NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS

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
- ❑ K-3
- ❑ 4-6
- ❑ Junior High/Middle School
- ❑ Senior High
- ❑ 2-Year College/Technical
- ❑ 4-Year College/University

MEMBERSHIP STATUS
❑ New ❑ Former/Renewing Member # _________

MEMBERSHIP DUES

- ❑ 1 year: $10.00 __________
- ❑ 3 years: $25.00 __________
- ❑ 10 years: $75.00 __________
- ❑ Full-time Student: $5.00 __________
- ❑ Contribution to Trust Fund: __________

Total Payment Enclosed: __________

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Exp. Date ____________________

Signature ____________________

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