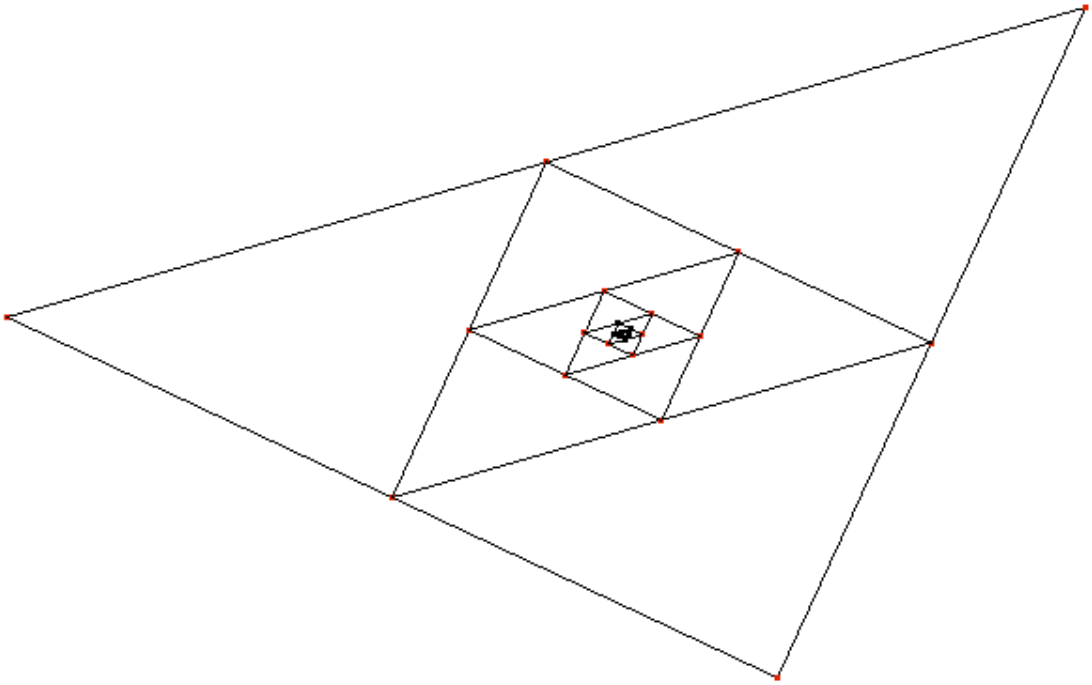
The Centroid



In This Issue:

Official Journal of the North Carolina Council of Teachers of Mathematics
Volume 31 • Number 2 • Fall 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

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 31 • NUMBER 2 • FALL 2005

Articles

News & Information

From the Editor

The Transition to SCS 2003

Holly Hirst
Appalachian State University
Boone, North Carolina

Another summer is over, and we are starting a new school year. Here at the *Centroid*, Brian and I are reading the submissions we received in the last three months in preparation for the review process this fall. We are pleased that you are sending us submissions. We need more! Please consider submitting, especially if you have a cool classroom activity to share. We have also changed the requirements for submission—one electronic copy via email or on a disk in the US mail is sufficient.

In her message, President Jeane Joiner describes fall as a time of renewal. This fall is also a time of implementation. The new NC math curriculum for grades 9 through 12 will be "officially" taught this year, with both old and new curricula in effect through the transition documents for algebra 1, geometry, and algebra 2. As an interested observer in discussions about these documents, I appreciate the work required of teachers in these courses; good luck!

We hope that you will enjoy the articles in this issue. The math societies advocate deep understanding of elementary concepts, and to this end we have included an article on radicals. In light of NCTM's new position statement on computation in the classroom (see page 9), a discussion of calculators as presented in "Knowing when to which" seemed timely. Anyone who has looked at census data for North Carolina will understand the rationale for the article on teaching LEP students. Finally, we include a handy worksheet designed to reduce the time it takes teachers to pull grades together at the end of a term.

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

NCTM in the News

One way to keep up with education news is to read the news clips mentioning NCTM and mathematics education. Many are posted on the NCTM website.

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

Presidents' Messages

State President
Jeane Joyner

In conventional wisdom, spring is the season of renewal, but this is not necessarily true for teachers. Fall is a time of new and exciting beginnings. New groups of students come to us to spend a year learning mathematics under our guidance. Whether a teacher, administrator, or educational leader in some other capacity, fall brings us opportunities to begin anew with the challenges students always present.

NCCTM also faces challenges. We must decide which services our professional organization, run by volunteers, should provide to help members "recharge" and continue to be learners. How do we best help novice and veteran teachers prepare for ever-changing student populations? How do we identify, recognize, and utilize outstanding teachers of mathematics? What strategies do we employ to help our members put research into practice, make wise decisions about curricular materials, and become less intimidated by the pressures of accountability testing? In what ways can we, as an organization, help to address the real problems that face schools today–problems such as a shortage of qualified mathematics teachers, an increasingly diverse student population, and accountability pressures that may hinder rather than support quality teaching and learning? How do we convince those who control budgets and disperse funds to support teachers' participation in professional development through NCCTM?

If we are to respond to these questions in positive and powerful ways, we need to work together to make wise decisions. NCCTM is *your* professional organization as teachers of mathematics. Because we are dedicated to serving our members and, through them, students across North Carolina, we can be most effective when we make specific efforts to involve many teachers at every level, preK through higher education. The bottom line, I believe, is NCCTM will be only as effective as *you* make it.

If you are like me, attending an NCCTM fall conference is always a joy. I see old friends, learn different ideas and strategies, examine materials, meet new people, and often leave with something intriguing to think about. But quality conferences do not just happen. They come together through hundreds of hours of work by numerous volunteers. Conference and program committee members donate their professional time to put together a program and sort through details to make the conference run smoothly. Presenters spend hours preparing talks. Teeshirts with new math logos result from teachers and their students submitting logo ideas, volunteers sorting and judging, and colleagues completing paper work, ordering shirts, and manning a booth. For example, NCCTM has a Marketplace with donated materials that are sold for miniscule amounts to support new mathematics teachers.

In her May 12 email message to National Council of Teachers of Mathematics members, Cathy Seeley, NCTM President, wrote

> It is oversimplified, unrealistic, and unfair to try and raise students' achievement in mathematics simply by putting pressure on teachers to "try harder." To assume that teachers aren't already "trying hard enough" is grossly inaccurate. Across the board, teachers want students to achieve at high levels, and they do whatever they can to help them learn.

Anyone who has ever examined the hours of time donated by so many educators in working with the various levels of the State Mathematics Contest or sat in the classrooms of those we honor as outstanding teachers of mathematics or participate in the programs funded through NCCTM's mini-

grants knows that North Carolina teachers are working very hard to help their students find success in mathematics. Look at our math fairs, this professional journal, the scholarships we award! In so many ways, mathematics educators in North Carolina should be cited as models for others to copy.

We cannot, however, rest on our past achievements. In order to continue as a vital organization all of us must bring fellow mathematics educators into the organization and take an even more active role in NCCTM's endeavors. If each member invites and involves one more mathematics educator each year, think about what we could do together! We have wonderful mentors in our midst. The expertise among retired and veteran NCCTM members is there waiting for you to tap into.

Would you like to get involved right away? Consider applying for a mini-grant, involve your class in the logo contest, have your students participate in a mathematics contest, or create a project for the math fairs. Ask your principal or supervisor for support and attend the NCCTM fall conference. There will be several different conference opportunities this year that you can read about in the preliminary program. Contact me <joynerj@meredith.edu> or your regional president, and let us know what interests you the most. We value volunteers!

I firmly believe that we as an organization, through the efforts of each member, can meet the challenges of nurturing our professional growth while we help our students reach increasingly high mathematical goals.

Eastern Region President
Julie Kolb

Greetings to the members of the Eastern region. Thank you to the past board members for their hard work and leadership during the last term; special thanks to Kathy Hill for her dedication to our organization and for the professional guidance that she has provided. Finally, thank you for giving me the opportunity to serve as your president. 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.

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

The 2005 Spring Conference at Meredith College in Raleigh was so great that we have decided to do it again! Thank you to everyone who played a part in creating and conducting such a wonderful staff development and networking opportunity. The Central and Eastern Regions are planning another joint Spring Conference to be held at Meredith at the end of February; let's hope that the weather cooperates.

I hope that you have had a relaxing and productive summer and are eager to start a new school year. I have enjoyed a little bit of vacation time and have also had the opportunity to participate in some very interesting and worthwhile staff development activities. It's always nice to meet with other professionals to gain new ideas and activities for the classroom!

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 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 pro-

grams (perhaps you would like to make a presentation).

Make it a great school year!

Central Region President
Emogene Kernodle

Greetings from the Central Region. For most, this summer has been a little longer for relaxation and reflection of the past school year(s).

We would like to thank our outgoing officers, Vicki Moss, Tina McSwain, Patty Schram, Barbara McGill, Susan Friel, and Amy Travis for their great leadership for the past two years. They have truly shown their dedication and commitment to our organization. We will continue to look to them for their guidance and support.

The State Mathematics Conference will be October 13-14 at the Koury Convention Center in Greensboro. Central Region members Dot Doyle and Maria Hernandez, program chairs, have built a great program and Barbara McGill, conference chair, has worked hard to make the conference a meaningful educational event. We appreciate the work of other Central Region members who give of their time and effort to make the annual conference a success.

The joint regional conference in the spring of 2004 with the Eastern Region was deemed a success. We have planned to join them again on February 25, 2006 at Meredith College. Mark your calendar now!

Not too long ago someone asked me the benefits of joining NCCTM. Two benefits for NCCTM members are the scholarship program for those who are pursuing graduate studies in mathematics education and the Mini-Grant awards for excellence in mathematics education. For students, NCCTM sponsors the Math Logo Contest and Mathematics Fairs. You will find information about these and other activities here in the Centroid or at the NCCTM website <http://www.ncctm.org/>. Don't forget to check this website as well as the NCDPI site <http://community.learnnc.org/dpi/math> often for details and updates on math related activities.

I look forward to working with the new Central Region vice presidents, Sylvia Davis, Karen Ellis, Elaine Tucker, Cos Fi, and secretary, Angela Flowers. We want to serve you. Please let us hear from you to let us know your needs and interests.

Western Region President
Carmen Wilson

Greetings! I hope that you enjoyed the summer months and that you are ready now to begin an exciting new school year.

Thanks to everyone who helped with the Western Region Math Fair and Western Region Spring Conference in 2005. The Western Region Math Fair was held on March 19th at Appalachian State University. One hundred seventy-nine students, representing 33 schools in our region, participated in this event. Over 350 in-service and pre-service teachers attended the Spring Math Conference held at the Hickory Metropolitan Higher Education Center on February 26th. The event was really two conferences at one site. Pre-service teachers attended sessions that were themed "Getting Started in the Teaching Profession." They took away some great ideas as well as some handy door prizes. Sessions for experienced teachers were about "Assessment and the Newly Revised Standard Course of Study in Mathematics." It was great to see so many teachers participating in this conference.

We are planning the 2006 Western Region Spring Conference already. The date will be Saturday, February 18th and the location will be the campus of Appalachian State University. Mark your calendars now and 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 <cwilson@ashe.k12.nc.us, 336-246-2400>.

As you busy yourselves with all of the challenges that a new school year brings, don't forget to let this organization help you in your classroom. NCCTM mini-grant ap-

plications are due by September 15th. The state conference is in Greensboro on October 13th and 14th. Plan now to attend, and get ready to be energized by the exciting new ideas your colleagues will be sharing in the many sessions and workshops.

Finally, as you nurture your students and watch them grow, why not grow along with them? Perhaps this is the year to begin a Masters program, pursue National Board Certification, participate in Teacher Action Research, or incorporate some new technology into your classroom. Whatever you decide to undertake this school year, best wishes to you and your students!

NCCTM Fall Conference

35th Annual Conference of the North Carolina Teachers of Mathematics

Building Student Success Through Rich Mathematics

October 13 and 14, 2005

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

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

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

The conference program will be posted on the NCCTM website a month prior to the conference. Contact Cyndy Davis <davisc@guilford.k12.nc.us, 336-288-7081> for more information.

Hope to see you there!

Bite Sized Mathematics: The Case of the Radical

Cos D. Fi[1]
University of North Carolina at Greensboro
Greensboro, NC

> Studying subject matter in relation to subject matter pedagogy helps teachers be more effective.

In this article, we will explore the meaning of the radical ($\surd$) and explore its use in resolving simple quadratic equations. In accordance with the Ball, Bass, and Hill (2004) quote above and with the recommendations from the MET report (CBMS, 2001), this article represents an attempt to engage middle and secondary school mathematics teachers in the exploration of the nuanced complexities of important mathematics concepts, namely solving simple quadratics using radicals.

Quadratics are important in many contexts such as area, trajectory (path) of an object thrown at an angle between 0 and 90º, and the height of an object dropped from above ground, to name a few applications.

Radicals appear in the solution of many quadratics, and there is sometimes confusion as to what the radical symbol ($\surd$) actually represents. Textbooks and teachers are known to explicate that the radical represents the *principal square root*. What does that mean? Why do radicals sometimes seem to give one answer and other times two? Let us unpack the meaning of the radical ($\surd$) by examining the following questions:

(α) Suppose $x = 4$, is the square root of x just 2 or both 2 and –2?

(β) What is the value of $\sqrt{4}$? Is it just 2 or both 2 and –2.

(χ) What is the solution of $x^2 = 4$? Is it just 2 or both 2 and –2.

Questions α and β

Since by definition, the radical ($\surd$) represents the principal square root of the argument, and the principal root is always positive, the following holds for question α: $x = 4$ if and only if $\sqrt{x} = \sqrt{4}$ if and only if $\sqrt{x} = 2$. This shows that

$$x = 4 \text{ if and only if } \sqrt{x} = 2.$$

Hence the solution set to question α is just $\{2\}$, which also answers question β. That is, $\sqrt{4} = 2$, and nothing more.

Question χ

This question is different from the two previous questions in fundamental ways. In particular, we will show that $x = 2$ is not equivalent to $x^2 = 4$ at the conclusion of our exploration of question χ.

In many mathematics classrooms, teachers and students engage in the following mathematical wizardry:

$$\text{If } x^2 = 4, \text{ then } x = \pm 2.$$

First of all, the conclusion in this statement actually represents the two equations $x = 2$ or $x = -2$. If the original question had asked for the solution to the equation $x^2 = 4$, then providing another equation does not fully resolve the original equation. In fact, the correct solution ought to be the set $\{-2,2\}$. Thinking about solutions as sets demonstrates that the equation $x = 2$, which has the solution set $\{2\}$, is not equivalent to

[1] *Dr. Fi is an assistant professor of mathematics education in the Department of Curriculum and Instruction at UNC-G and serves as the College Vice President for the Central Region of NCCTM.*

the equation $x^2 = 4$, which has the solution set $\{-2,2\}$.

The major problem with the solution method that yields $x = \pm 2$ through wizardry is that the underlying mathematical processes and concepts remain a mystery. Through this wizardry, students may be led to the belief that the radical ($\sqrt{\ }$) can actually produce both positive and negative numbers. We ought to challenge this belief with mathematical reason and help students understand that mathematics makes sense and that mathematics coheres beautifully.

Reconsider the equation $x^2 = 4$. Let us retain the definition that the radical is the principal root and can only produce positive numbers. The following argument unpacks the mystery and substantiates the wizardry on sound mathematical arguments and constructs.

The properties of equality and the definition of the radical ($\sqrt{\ }$) as the principal square root support the following argument:

$$x^2 = 4 \text{ if and only if } \sqrt{x^2} = \sqrt{4}.$$

Moreover, since the radical produces only positive values, $\sqrt{x^2}$ must be a positive quantity and so the following holds:

$$\sqrt{x^2} = \sqrt{4} \text{ if and only if } |x| = 2.$$

We need to apply the definition of the absolute value function to complete the problem. If x is negative, then $|x| = -x$, since $-x$ is positive when x is negative. If x is positive then $|x| = x$. Hence, we get the results as shown in Table 1 from the equation $|x| = 2$.

$\lvert x\rvert = 2$ and x is negative	$\lvert x\rvert = 2$ and x is positive
$\Leftrightarrow -x = 2$ with $-x > 0$ $\Leftrightarrow x = -2$ The solution set is $\{-2\}$	$\Leftrightarrow x = 2$ The solution set is $\{2\}$
Hence the solution set to the equation $\lvert x\rvert = 2$ is $\{-2,2\}$. Thus the solution set to the equation $x^2 = 4$ is also $\{-2,2\}$.	

Table 1. $|x| = 2$ *and its equivalence to* $x^2 = 4$

The previous discussion shows that we can help students understand the mathematical "short hand"

$$\text{if } x^2 = 4, \text{ then } x = \pm 2,$$

by unpacking the meaning and structure of the radical using equivalent equations, the definition of the absolute value function, and properties of equalities. By focusing on sense making and learning with understanding, teachers can help students appreciate the logical integrity of mathematics. More importantly, students might begin to appreciate the meaningfulness of mathematics and the nature of mathematical truths as based on reason and not just because the teacher said so. Such pedagogy promises to promote students' agency: Students will begin to view themselves as doers of mathematics and not just consumers of mathematics or outsiders to mathematics.

I would be remiss if I did not highlight a possible misinterpretation of the previous mathematical argument that can result from an uninvolved look at the applied processes. It seems as if I have produced a negative number (-2) from an argument that claimed that $\sqrt{x^2}$ is a positive quantity. It is true that $|x|$ is a positive value and $\sqrt{x^2} = |x|$, since the radical ($\sqrt{\ }$) produces only positive values. However, x itself can be either positive or negative. A similar argument is equally important in generating the inverse for $f(x) = x^2$. Note also that $-\sqrt{\ }$ produces a negative value and should not be confused with $\sqrt{\ }$ or $\sqrt{(\text{negative value})}$.

Other questions for curriculum depth

- In what other ways can you convince your students that $\sqrt{x}$ yields only positive values?
- How will you distinguish $-\sqrt{\ }$ from $\sqrt{\ }$?
- How will you help students understand that $\sqrt{(\text{negative value})}$ is not a negative number?
- How do these arguments affect the process of finding the inverse of $f(x) = x^2$?

References

Ball, D. L., Bass, H., & Hill, H. (2004, January). *Knowing and using mathematical knowledge in teaching: Learning what matters*. Paper presented at Southern African Association of Mathematics, Science, and Technology Education, Cape Town, South Africa.

Conference Board of the Mathematical Sciences (CBMS). (2001). *The mathematical education of teachers*. Providence, RI: American Mathematical Society.

The Materials Marketplace at the NCCTM Conference

As those of you who attended the Conference in Greensboro last year know, NCCTM started a new program: The Materials Marketplace. Preservice and new inservice teachers were invited to come and purchase at rock bottom prices all sorts of materials—textbooks, technology, supplies, etc.—to start building their resource base. It was wildly successful! There seemed to be a lot of stuff to sell, until the marketplace opened. The materials were gone in record time, and all involved raved about the success of this venture.

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.

Please contact coordinators Kim Aiello and Shana Runge <ncctmmarketplace@hotmail.com> if you have materials to contribute.

NCTM Issues New Position Statement

Computation, Calculators, and Common Sense

Question: Is there a place for both computation and calculators in the math classroom?

NCTM Position: School mathematics programs should provide students with a range of knowledge, skills, and tools. Students need an understanding of number and operations, including the use of computational procedures, estimation, mental mathematics, and the appropriate use of the calculator. A balanced mathematics program develops students' confidence and understanding of when and how to use these skills and tools. Students need to develop their basic mathematical understandings to solve problems in and out of school. For the full Position Statement go to <http://www.nctm.org/about/position_statements/computation.htm>.

NCTM Positions and Position Statements define a particular problem, issue, or need and describe its relevance to mathematics education. Each statement defines the Council's position or answers a question central to the issue. The NCTM Board of Directors approves all positions and position statements. The newly released Position on calculators is in addition to the two previous Position Statements on the subject.

Knowing *When* to *Which*: Addressing the Calculator Quandary

Carrie S. Cutler[1]
University of Houston
Houston, Texas

Should an elementary school teacher *always* make calculators available to students? How does a teacher know when the use of a calculator is appropriate? More importantly, how can we strengthen our students' discernment about when to use a calculator, mental math, paper and pencil, or physical manipulatives?

The calculator serves as a valuable tool to enhance exploration, problem solving, and real-world applications. Nonetheless, as a former classroom teacher and current instructor of preservice elementary mathematics teachers, I witness firsthand the confusion surrounding the prudent use of calculators in the elementary classroom. Often, I hear comments such as:

> I don't think there is any room for calculators in the elementary classroom. —Parent
>
> I don't know when to let my students use calculators, so I usually just keep them in the cupboard. —Classroom teacher
>
> You ask any sixth grader on the street, and they can't tell you what two plus two is. They won't learn the basics if they have a calculator. That's all there is to it.— Preservice Teacher

The National Council of Teachers of Mathematics' Principles and Standards for School Mathematics (2000) espouses computational fluency, but encourages balance between that fluency and conceptual understanding. The document equally advocates both efficient computation and the ability to wisely select strategies and tools.

When to Which

To engage teachers, parents, and students in a discussion about the judicious use of calculators, I begin by asking about their preferred computation strategies—those approaches they find most efficient and effective. We list the strategies on the board and group them into four general categories: manipulative (concrete), paper and pencil, mental math, and calculator (technological).

I then divide the participants into groups of five and assign one person to use the calculator, another to use mental math, another to use paper and pencil, and another to use base ten blocks to represent and solve computation items. The fifth member of the group serves as the judge and recorder, responsible for certifying who solved the problem most quickly and keeping a tally of the results for each problem.

Next, I display one arithmetic problem at a time on the overhead (Figure 1) and remind the participants to solve the problem with their assigned tools.

Following the exercise (and a flood of giggles and groans from the groups), we discuss our results. Parents, teachers, and students often comment on their surprise in seeing that mental math is not the quickest approach for every arithmetic problem. Often, those who are compelled to punch a memorized math fact into the calculator or lay out an absurd number of manipulatives express frustration with the unwieldiness of their assigned method. Participants note that selecting a tool or strategy requires a great

[1] *Ms. Cutler has taught both first and fourth grades in Utah and Idaho and is completing her doctorate this year in Curriculum and Instruction – Mathematics Education at Houston, where she teaches mathematics methods courses.*

deal of judgment—of knowing *when* to *which*. We generally conclude the activity with a consensus that students need a quiver full of strategies from which to select wisely as well as plenty of opportunities to hone their decision-making skills.

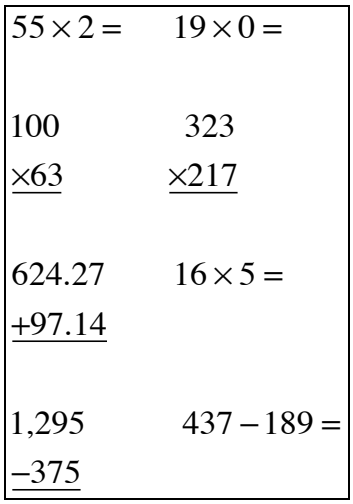


Figure 1. *Arithmetic problems for overhead.*

Personal Rationales for Calculators

Teachers must develop personal rationales for their decisions regarding the use of calculators in their classrooms. They should begin by asking: Is the calculator essential for maintaining the quality of the task? Would the calculator allow for the use of real-world data or connections that would otherwise be prohibitive? (Thompson & Sproule, 2000).

Recently, I watched a primary class extend a picture book about pizza into a rich mathematical task facilitated by the use of calculators. The students expressed great curiosity about a pizza's ingredients. They wanted to know how much cheese the cafeteria staff would need to make enough pizzas for everyone in the school to have a slice. Students energetically engaged in discussion about the problem, offering their suggestions and conjectures, and eventually reasoning through the mathematics involved in the investigation.

> "First we need to know how many people are in the school. I think we should add up the first graders, then the second graders, and start there," proposed one student.
>
> Another student disagreed, "No. First we need to know how much cheese goes on the pizzas."

The students pursued multiple avenues in solving the problem. Calculators enabled the students to use the actual numbers involved—rather than less realistic, but more computationally feasible, lower digits. The students found personally satisfying results, especially when they involved the cafeteria staff and the principal in their wrap-up pizza party.

Whether the activity focuses on *process* or *product* influences a personal rationale for calculator (Thompson & Sproule, 2000). A process-oriented activity involves students in problem solving or mathematical exploration. Here the calculator can help students focus on *what* calculations to perform, not just *how* to perform those calculations, thus enhancing exploration, problem solving, and real-world applications (Reys & Arbaugh, 2001). A product-oriented activity, on the other hand, most highly values the determination of a computational result. In this case the calculator serves as a mere computational tool, limited to figuring the correct numerical solution. In the pizza problem, valuable mathematical processes were the focus rather than the accurate computation of the amount of cheese—the product.

Many teachers and students believe that using a calculator guarantees speed and accuracy of computation, but little else. Proponents of calculator use, however, note its unique potential for developing number sense and positive dispositions toward mathematics (Charles, 1999). Indeed, a myopic view of a calculator as a quick-fix for arithmetic ignores its value for allowing students to easily explore mathematical concepts and efficiently solve problems using a variety of creative approaches. Students may investigate place value, discover new phases of skip counting, search for number patterns, and examine number magnitude while using the calculator to visualize very large and very small numbers.

Just as teachers refine their individual rationales for calculator use, students should, through experience with process-oriented tasks, begin to develop their own sense of *when* to *which*, thus observing the calculator's utility in solving real-world problems that require rigorous reasoning and problem solving.

Conclusion

Should an elementary school teacher *always* make calculators available? How does a teacher know *when* to *which*? The calculator is essential when the focus of instruction is a process-oriented task involving real-world numbers that may be beyond the scope of students' computational ability. The use of the calculator expedites the problem-solving process, allowing students to move beyond arithmetic to the "meat" of mathematics—reasoning, conjecture, and so forth. Through continual experience with rich, process-oriented tasks that foster wise decision making, students in turn develop judgment about *when* to *which*. A teacher noted: "I can see that, when I make calculators available and students choose to use them, the students are more autonomous and motivated. Liberated from time-consuming computation, they can focus on exploring the rich mathematics involved in the task."

References

Charles, R. I. (1999, May/June). Calculators at the elementary school level? Yes it just makes sense! Mathematics Education Dialogues, 2(3), 11.

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

Reys, B. J., & Arbaugh, F. (2001). Clearing up the confusion over calculator use in grades k-5. *Teaching Children Mathematics, 8*(2), 90-94.

Thompson, A. D., & Sproule, S. L. (2000). Deciding when to use calculators. *Mathematics Teaching in the Middle School, 6*(2), 126-129.

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 2005 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>.

Strategies to Support Mathematical Understanding of LEP Students

David K. Pugalee[1]
University of North Carolina at Charlotte
Charlotte, NC

Ian Brailsford[2]
University of North Carolina at Charlotte
Charlotte, NC

Theresa Perez[3]
University of North Carolina at Charlotte
Charlotte, NC

Language has traditionally taken the backseat in mathematics classrooms. This is especially problematic for students with Limited English Proficiency (LEP), and inhibits the type of learning environment indicative of developing mathematical understanding. According to the 2000 United States census, a language other than English is spoken in approximately 18% of households, with Spanish being the spoken language in more than 10% of these homes. As of 2002-2003 slightly more than 10% of all U.S. students are limited English proficient (Callahan, 2005). In North Carolina, a language other than English is spoken in more than 8% of the homes, with Spanish as the spoken language in approximately 5%. According to the NC Department of Public Instruction, there were more than 78,000 LEP students enrolled in public schools in the 2003-2004 academic year, about 5.9% of the total enrollment thus representing an increase of approximately 494 percent over the previous decade. The educational attainment of our nation's Hispanic population is especially troubling. According to a recent study (Secada et. al, 1998):

- Nearly one in five of our nation's Hispanics between the ages of 16 and 24, who have been enrolled in a United States school at one time, left school without a high school diploma or equivalent;
- The Hispanic dropout rate is estimated at a staggering 30%;
- Hispanics account for 56% of all U.S. immigrants but account for nearly 90% of all immigrant dropouts.

In order to address the needs of ESL students, mathematics must be a targeted content area. Analysis of the 1996 National Assessment of Educational Performance found

[1] *An associate professor specializing in mathematics education in the department of middle, secondary, and K-12 education at UNC-C, Dr. Pugalee coordinates the PhD program in curriculum and instruction.*
[2] *Mr. Brailsford just completed requirements for the M.Ed. with an emphasis in Teaching English as a Second Language from UNC Charlotte. He currently works with Central Piedmont Community College.*
[3] *Dr. Perez is a professor in the department of middle, secondary, and K-12 education and specializes in bilingual and multicultural education.*

that non-LEP students performed better on the mathematics test than LEP students, and these differences held even after controlling for students' reading levels (Abedi, Lord, & Hofstetter, 2001). LEP students can benefit from teachers' explicit actions addressing their limited language skills. This paper will provide some general guidelines for addressing the needs of limited English proficient students in studying mathematics and some specific strategies that can improve all students' mathematical understanding (MacGregor & Moore, 1995; Lanou, 2000).

The role of language needs to be better integrated into the math classroom in order to promote a better understanding of the concepts that are presented. There are three main areas to address in approaching linguistically diverse learners. The *knowledge* area consists of choosing relevant contexts and building on prior knowledge. The *vocabulary* area consists of identifying key words and having students express concepts in their own words. The *concept* area consists of careful planning for presenting abstract concepts and the use of manipulatives.

The Knowledge Area

It is important to choose relevant contexts when presenting mathematical problems. Ordinary words may have a specialized meaning that we, as Americans, take for granted as general knowledge. Lily Wong Fillmore (2002) gives an excellent example in presenting the idea of pizza size in inches. To some it is obvious that a size of 12″ in a word problem refers to the diameter. For those not familiar with American culture, this measurement could very well refer to the radius or circumference of the pizza! Additionally, although the use of standard English units for measurement is useful, an emphasis on metric units will provide a familiar context for many students from countries where the metric system is commonplace. The metric system of measurement will also be important for future learning experiences, such as in chemistry or physics classes.

Instruction involving the language of mathematics should not be separate from math (MacGregor & Moore, 1995). Students need to be proficient in all four areas of English, i.e. reading, writing, listening, and speaking. Whereas most math classrooms utilize reading and listening skills, little time is devoted to speaking and writing. The development of a knowledge base must include emphasis on mathematics content as well as all four of these areas of language. The use of small groups provides an effective, efficient, and engaging arrangement for students to develop facility with language while developing important mathematical understanding.

Building on prior knowledge is an essential strategy for teaching any subject. This can be done through the use of pictures to elicit meanings (Lanou, 2000). Drawing exercises that emphasize students' facility with mathematical ideas and expressions are powerful experiences that assist students in making important connections. For example, students are asked to describe a graph without showing the picture to the other members of their group. The other students then sketch the graph and write a representative function from the given verbal description. Students then rotate, describing and drawing their respective graphs. Finally, students compare their graphs and discuss any discrepancies. This allows students to reinforce the relationship between the graphical, verbal, and symbolic representations.

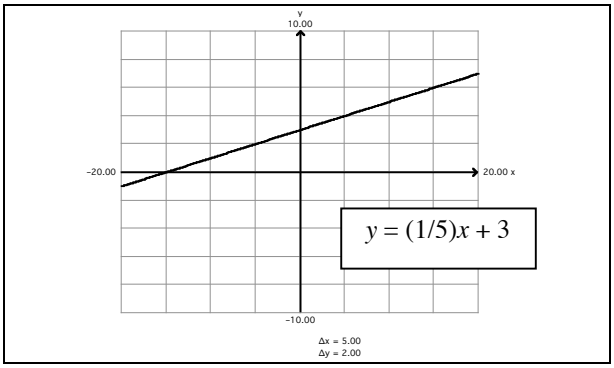
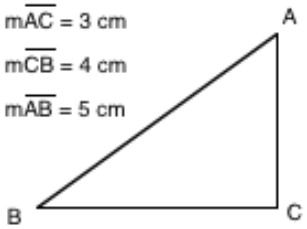


Figure 1. *Example of a graph for student descriptions*.

The Vocabulary Area

The teaching of key word vocabulary is helpful not only for LEP students. Maintaining vocabulary lists helps all students to organize data in a logical fashion (Lanou, 2000; MacGregor & Moore, 1995). Cloze exercises are a good way of reinforcing language in the math classroom. In cloze exercises students select from a list of words, frequently words that have conceptual density in mathematics, to complete statements, as in Figure 2.



Rectangle Triangle Pentagon Three Four Five Six Ten Twelve Hypotenuse Area Perimeter Circumference Length

This shape is a _____.
It has a base of _____ centimeters.
½ of the base times the height gives an area of _____ cm^2.
The _____ is 12 centimeters.

Figure 2. *Cloze exercise for reinforcing vocabulary and concepts*

However, it is important to remember that the teaching of academic language, i.e. key words, in itself is not enough. Students need to think about the ways in which the language is used.

Going over word associations, such as synonyms, is an effective technique for defining new vocabulary and also increases the students' speaking and writing skills (MacGregor & Moore, 1995). Labeling and card matching exercises are also useful techniques for connecting words with numbers and equations. Students benefit when teachers of mathematics consult with the rest of the faculty in order to coordinate learning activities and plan/develop instructional strategies. Data suggests that if teachers learn some math-related vocabulary in Spanish, or reinforce math vocabulary with Spanish equivalents, they might be able to assist a majority of their LEP students in learning concepts.

Having students express concepts in their own words is another strategy that can be used. This may take place through information sharing or cooperative problem solving (MacGregor & Moore, 1995). It is also important that students have the opportunity to develop concepts in not only English, but also their native language. Conceptual understanding is easier if it is first learned in students' native language and followed by its application in the English-speaking classroom (Wong Fillmore, 2002). For classrooms where bilingual resources are available, students benefit if they can access information in their native language as a precursor to developing those concepts in English. This includes providing students opportunities to discuss concepts in their native language with others.

The Concept Area

Presenting abstract concepts has always been a difficulty for math instructors. A good approach to overcome this challenge is to first develop concrete examples using manipulatives. This will make abstractions easier to understand. The notion of abstract concepts should be presented to children while they are still young. At around age 7, most children are both physically and mentally able to start comprehending logical reasoning. Therefore it is important for teachers to start modeling early.

Manipulatives are important tools from a developmental perspective as students move from concrete to abstract ideas. Cummins (1981) argues that visual supports make language more comprehensible. Students who "see" concepts through physical manipulatives can understand those concepts more readily than if the ideas are only explained abstractly using vocabulary that is not entirely familiar to the students.

Examples of manipulatives include Cuisenaire rods and problem reconstruction using cards. (Lanou, 2000; MacGregor & Moore, 1995). The use of rulers, protractors, calculators, and computers are also effective manipulative tools. Graduated cylinders may be used to develop concepts related to volume. Graduated cylinders, flasks, and beakers available in many science classrooms can be used to illustrate volume concepts allowing students to develop proficiency in associating volume with a specific numerical quantifier. Such visual, hands-on experiences are more effective than the typical illustrations of volume provided in many textbooks. Fraction bars can also be an effective means of relating visual models to part/whole relationships. Students can be asked to do basic operations using the strips or make comparisons such as "How many fourths are in one half?" "Which is larger ¾ or 2/3?"

1/2		1/2	
1/3	1/3	1/3	
1/4	1/4	1/4	1/4

Figure 3. *Sample Fraction Bars*

Conclusion

As the reader may have already surmised, the most effective strategy for approaching the LEP population lies in an integration of various strategies. Language needs to be better integrated into the math classroom in order to promote conceptual understanding. Strategies for approaching such instruction include choosing relevant contexts that build on prior knowledge; identifying key words and having students express concepts in their own words, and careful planning for presenting abstract concepts using manipulatives. These strategies may be used in isolation, but the combination of these various strategies creates an effective learning environment for *all* students, not just those with limited English proficiency. Thus success in communication has gone from a seemingly impossible to an obtainable goal and the realization of mathematical power for all students is closer to attainment.

References

Abedi, J., Lord, C., & Hofstetter, C. (September, 2001). *Impact of selected background variables on students' NAEP math performance*. Washington, DC: National Center for Education Statistics, Office of Educational Research and Development, Department of Education. [Publication NCES 201111]

Callahan, R. M. (2005). Tracking and high school English learners: Limiting opportunity to learn. *American Educational Research Journal,* 42(5), 305-328.

Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. In Schooling and language minority students: A theoretical framework (pp. 3-49). Office of Bilingual Bicultural Education, California State Department of Education, Sacramento. Los Angeles: Evaluation, Dissemination and Assessment Center, California State University.

Lanou, E. (2000). Instructional strategies: Ridding math word problems of language barriers. *The Link, 19*(2). [Online at http://www.ael.org/link/, accessed October, 2001]

McGregor, M. & Moore, R. (1995). *Teaching mathematics in the multicultural classroom: A resource for teachers and teacher educators*. Adelaide, Australia: Australian Association of Mathematics Teachers.

North Carolina Department of Public Instruction. (2004). *2003-2004 Facts and Figures*. [http://www.ncpublicshools.org/fbs/].

Secada, W. G. et. al. (February, 1998). *No more excuses: The final report of the Hispanic dropout project*. Washington, DC: U.S. Department of Education.

Wong Fillmore, L & National Association for Bilingual Education. (2002). Teachers teaching or teachers testing? A question of priorities [videotape]. *NABE Star Series Volume 1*. Washington, DC: NABE.

2005 State Math Fair Winners

Primary Division, Grades K-2

1st Place: Nicholas Kowalski
"The Probability of Being Like Me"
South Greenville Elementary School
Greenville, NC

2nd Place: Mrs. Barb Frea's Class
(reps: Julie Fulk & Andrew Holmes)
"What Kind of Truck Would You Like to Ride In?"
Pinnacle Elementary School
Pinnacle, NC

3rd Place: Ethan Walters
"Measuring It Up"
Codington Elementary School
Wilmington, NC

Honorable Mentions

Alec Laning
"Pulleys"
Lake Norman Elementary School
Mooresville, NC

Livi Guglielmi
"My Little Pony Parade"
Lake Norman Elementary School
Mooresville, NC

Alex Suggs & Dane Hedgepath
"Put Your Right Foot In, Do the Measuring, That's What It's All About"
Snow Hill Primary School
Snow Hill, NC

Samantha Freeman
"Lake Norman Elementary School Supply Fundraiser"
Lake Norman Elementary School
Mooresville, NC

Elementary Division, Grades 3-5

1st Place: Steven Holloway
"Mathematics: The Cornerstone of Architecture"
Little River Elementary School
Durham, NC

2nd Place: Eli Stutzman & Daniel Monzel
"Traveling Salesman Problem"
Davidson Elementary School
Davidson, NC

3rd Place: Max Copeland & Alec Castillo
"How Many Trees Are In the Forest?"
Lake Norman Elementary School
Mooresville, NC

Honorable Mentions

Brittany Smith & Taylor Parks
"Pig Versus Cow"
D.F. Walker Elementary School
Edenton, NC

Keyshon Coston & Emmy Mathias
"Dessert, Anyone?"
D.F. Walker Elementary School
Edenton, NC

Honorable Mentions (continued)

San Coston
"On the Road Again"
D.F. Walker Elementary School
Edenton, NC

Katie Moses
"The Pony That Eats Like a Horse"
Lakeshore Elementary School
Mooresville, NC

Mrs. Debbie Sheron's Class
(reps: Lia Johnson & Kaitlyn Mason)
"How Is the Pisgah Covered Bridge Mathematical?"
Franklinville Elementary School
Franklinville, NC

Middle School Division, Grades 6-8

1st Place: Rebecca Lynn Gregory
"The Thrill of the Ride"
Camden Middle School
Camden, NC

2nd Place: Abdul-Rahman Eljabaly
"How Much Water is in the Pond?"
Al-Iman School
Raleigh, NC

3rd Place: Katie Shuford & Kristen Leger
"Sounds of Pi"
H.M. Arndt Middle School
Hickory, NC

Honorable Mention: Melissa Sawyer & Jeanine Koontz
"Which Fabric Dries the Fastest?"
Camden Middle School
Camden, NC

High School Division, Grades 9-12

1st Place: Maressa McCall
"The Power of One: An Exploration of Weighted Voting Systems"
A.C. Reynolds High School
Ashville, NC

2nd Place: Erica Wallace & David Johnson
"How Will You be Remembered"
Victory Christian Center School
Charlotte, NC

3rd Place: Bobby Schultz
"Anim-Matrices"
Raleigh Charter High School
Raleigh, NC

Honorable Mention: Rebecca Barket & Hannah Cherry
"Vedic Mathematics"
Hertford County High School
Ahoskie, NC

NCTM 2006 National Meeting

The next national meeting will be held in St. Louis, Missouri on April 26 through 29, 2006. Pre-registration will open in early November. See the NCTM website <http://www.nctm.org/> for more details.

State Math Contest Winners

John Goebel
Durhan Academy
Durham, North Carolina

The finals for the State Mathematics Contest in the Comprehensive Division were held at the North Carolina School of Science and Mathematics in Durham on April 28th, 2005. A week later, the State Finals in Algebra Two, Geometry, and Algebra One were held at three regional sites: UNC-Asheville, UNC-Greensboro, and NC Wesleyan College in Rocky Mount.

Before students can compete in these state finals, they compete at a regional qualifying site. To qualify for the Comprehensive Finals, a student must place in the top seven percent at one of these sites. To qualify for one of the other divisions, a student must place in the top ten percent. This year 123 students qualified for the Comprehensive finals, while 86, 87, and 82 students participated respectively in Algebra I, Geometry, and Algebra II. In the comprehensive finals, the top 40 students receive awards. In addition, many colleges and universities in North Carolina offer scholarships to the top students.

The top 10 students in the Comprehensive Division and the top five students in each of the other divisions are below.

COMPREHENSIVE:

Place	Student	School	Grade	Teacher
1	Jeremy Diepenbrock	Enloe High	12	John Noland
2	Arnav Tripathy	East Chapel Hill	10	Jay Wilson
3	Derrick Sund	Home School	11	Mary Sund
4	Yakov Berchenco-Kogan	Broughton High	10	Michael Clinkscales
5	John Pardon	Durham Academy	10	Verle Regnerus
6	Jeremy Hahn	East Chapel Hill	9	Virginia Johnson
7	Noah Blach	East Chapel Hill	10	Jay Wilson
8	Gregory Filpus	East Chapel Hill	12	Pete Shaginau
9	Amy Wen	NCSSM/Early College at Guilford	11	Maria Hernandez
9	Jim Ouyang	East Chapel Hill	12	Jay Wilson
10	Paul Huang	NCSSM /Durham School of the Arts	12	Dot Doyle

ALGEBRA I:

Place	Student	School	Teacher
1	Jenny Chen	E.B. Aycock Middle	Ruth Hicks
2	Cara Lewis	A.C. Reynolds Middle	William Punshon
3	Michelle E. Phillips	North Davie Middle School	Steve Rareshide
4	Chung-hyun Ma	Martin Middle School	Mrs. Slate
5	Michael Chang	Cape Fear Center for Inquiry	Elizabeth Woodside

GEOMETRY:

Place	Student	School	Teacher
1	HoSeok Lee	Guy B Phillips Middle	Angela Short
2	Kevin Li	Ligon GT Magnet Middle	Pat Heald
3	John Halvorsen	T.C. Roberson High School	Ms. Wood
4	Kevin Ji	Durham Academy	Jim McGivney
4	Jorge Ballesteros	Aycock Middle	Carolyn Warren

ALGEBRA II:

Place	Student	School	Teacher
1	William Schlieper III	Green Hope High School	Kathy Snapp
2	Andrew Tibbits	David Butler High	Mrs. Humphrey
3	Megan Heysham	T.C. Roberson High School	Ms. Hallman-Morris
4	James Finley	T.C. Roberson High School	Ms. Hallman-Morris
5	Brandon Reid	Western Guilford High	Catherine Miller

Out of these talented students, the teams that represented North Carolina at the American Regions Mathematics League (ARML) Meet at Penn State University on June 4th were selected. The top twenty students from the Comprehensive competition are automatically invited for the A team, as are other top-performing younger students for the B Team. The ARML Meet is the only national on-site contest with teams from the US, Canada, and occasionally teams from countries like Canada, China, Russia, and Bulgaria in attendance. The Duke Energy Foundation has given us a generous contribution for the past two years to send our teams to Pennsylvania at no cost to the students.

On June 3rd, 34 students and five coaches traveled to Penn State University to compete in the ARML meet. Head Coach Archie Benton from North Buncombe did an outstanding job selecting the teams, organizing practice sessions and problems, and recruiting the other coaches, Mary Sund (Fayettville Home School), Ken Twing, (Freedom High), Kathy Hill (retired: Athens Drive), and David Mermin (Duke Student and former ARML Team Member).

This year the A team placed seventh out of 29 teams in their division while the B team placed 24th out of 65 teams. Arnav Tripaty placed third in the Individual Round out of over 1400 students. The ARML Competition consists of four parts. Three of the events are team events: the Team Round, Power Round, and Relay. The final event consists of eight individual questions. The A team had a perfect score on the Team Round, tied for first on the Power Round, and was in second place going into the final Relay Round.

Students who would like to compete on the NC ARML teams should take the AMC and AIME test, compete in the State Mathematics Contests, and attend the ARML practice sessions that will be posted on the State Math Contest Website <http://courses.ncssm.edu/goebel/statecon/state.htm>.

Check it out!

The National Science Digital Library

The National Science Foundation created the NSDL to support innovations in teaching and learning in science, technology, engineering, and mathematics. The project has cataloged many excellent resources, and offers several search techniques. In addition to being a good place to find things, educators may sign up for the free newsletter and suggest resources for inclusion into the Library.

< http://nsdl.org/>

NCCTM Math Logo Contest Winners

From a field of approximately 3,600 entries, twelve logos submitted by the following students were judged to be the winners in the 2005 Logo Contest.

State Winner
Chris Gyori, Grade 11
Sanderson High School
Raleigh, NC 27609
Teacher: June Blackwell

Eastern Regional Finalists

Mary Lindsay West, Grade 2
Snow Hill Primary
Snow Hill, NC 28580
Teacher: Carol Taylor

Lacy McClure, Grade 8
Daniels Middle School
Raleigh, NC 27608
Teacher: Gena Cherry

Merry Nguyen, Grade 5
Forestville Road Elementary
Knightdale, NC 27545
Teacher: Meredith Weipert

Chris Gyori, Grade 11
Sanderson High School
Raleigh, NC 27609
Teacher: June Blackwell

Central Regional Finalists

Coral Young, Grade K
Glendale Acres Elementary
Fayetteville, NC 28304
Teacher: Kathy Denman

Callie Ricketts, Grade 8
Anson Middle School
Wadesboro, NC 28170
Teacher: Patricia McQueen

Merlee Purkerson, Grade 5
Lindley Park School
Asheboro, NC 27203
Teacher: Linda Isbell

Jamie Melvin, Grade 12
South View High School
Hope Mills, NC 28348
Teacher: Candy Phipps

Western Regional Finalists

Caeley Riordan, Grade 2
Mount Pleasant Elementary
Mount Pleasant, NC 28124
Teacher: Ms. Pat Freeman

Samantha Moody, Grade 8
Cane Creek Middle School
Fletcher, NC 28732
Teacher: Mary Gasaway

Justin L. Merrill, Grade 3
Brevard Elementary School
Brevard, NC 28712
Teacher: Ms. Yaxley

Leanna Watts, Grade 10
North Lincoln High School
Lincolnton, NC 28092
Teacher: Libby Fletcher

2006 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 2006-2007 school year. This logo will be used on a poster to promote interest in mathematics and as the basic design for NCCTM's 2006 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.

Please 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:_____

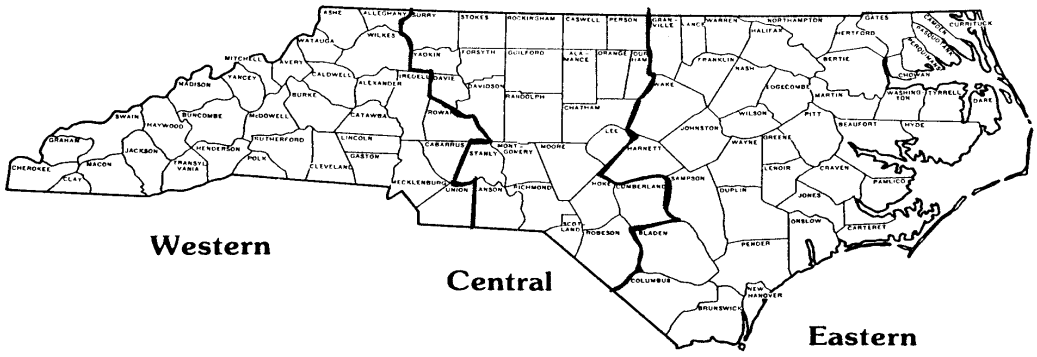
*NCCTM Region: Eastern Central Western
(circle one) *See NCCTM Regional Map Below

Submit the entries on **8 1/2 x 11 paper in black ink or black marker only.** Entries must be postmarked by 1 March 2006. Mail to:

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

North Carolina Council of Teachers of Mathematics

NCCTM Regional Structure



Problems to Ponder

Fall 2005 Problems

Gregory S. Rhoads
Appalachian State University
Boone, North Carolina

Grades K–2	The Smith children are counting their pennies to see if they can buy an ice cream cone. Sallie has 12 pennies. Susie has half as many as Sallie, and Paul has one third as many as Sallie. If they combine all of their pennies together, do they have enough to buy an ice cream cone that costs 20 cents?
Grades 3–5	A quantity and its half added together become 24. What is the quantity? *This problem is similar to the problems found on the ancient Egyptian Rhind Papyrus, circa 1650 B.C.*
Grades 6–8	"A square and 10 roots are equal to 39"—or, in modern terms, the square of a quantity plus 10 times that quantity equals 39—what is the number? Can you find the negative solution also? *This problem is from Hisab al-jabr w'al-muqabala,by al-Khwarizmi, 9th century A.D., thought to have been born in Baghdad.*
Grades 9–12	A square, walled city measures 200 paces on each side. Gates are located at the centers of each side. If there is a tree 15 paces from the east gate, how far must a man travel out of the south gate to see the tree? *This is from the ancient Chinese text, Nine Chapters on the Mathematical Art; the date is unknown, but commentary by Liu Hui on this text dates to 263 A.D. according to The History of Mathematics (Fifth Edition) by David Burton, McGraw Hill, 2003.*)

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 30 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.

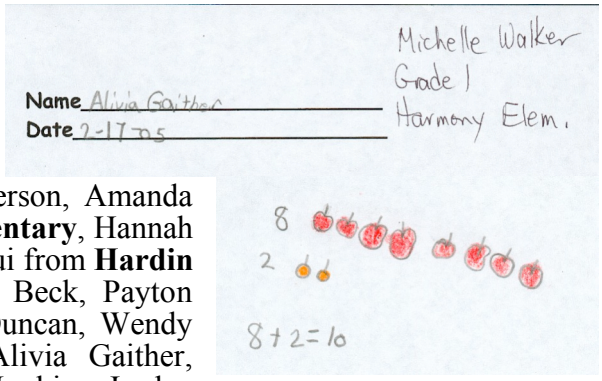
Erratum: In the Spring 2005 Problems to Ponder column, the students Rhiana Balmer, Caitlin Drake, Jonathan Jackson, Kayla Krender, Stephen Pearsall, Taylor Rogister, and Shae Scott from Moyock Elementary correctly solved the 3-5 problem and not the K-2 problem as reported. We apologize for the error.

Solutions for Problems from the Spring 2005 Issue

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?

Solution: Alivia Gaither, 1st grade, **Harmony Elementary** (teacher: Ms. Walker)

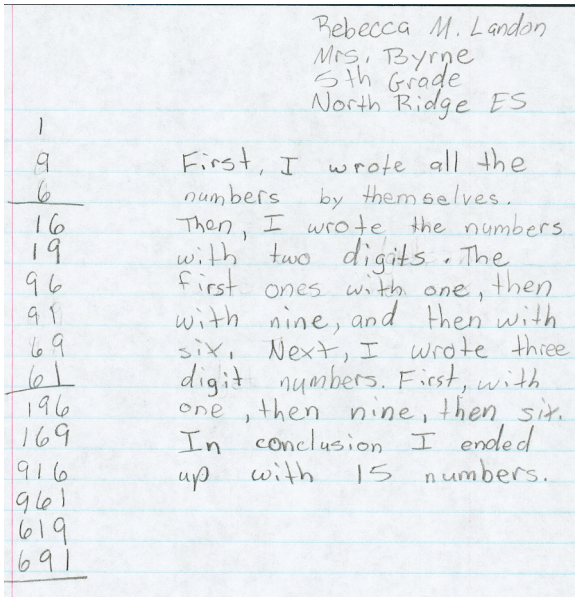


Correct Solutions were received from Issac Boulter, Noah Gavenus, Andrew Hall, Amber Hensley, Irsie Hilbert, Ernesto Leco, Payton Peterson, Amanda Robertson, and Zeb Snyder from **Burnsville Elementary**, Hannah Perry from **Conn Elementary**, Maria Joe M. Sanqui from **Hardin Park Elementary**, Autumn Atwood, Jacob Phil Beck, Payton Carther, Tanner Church, Allison Cullen, Tyler Duncan, Wendy Escobar-Cesar, David Ferretiz, Dupre Folks, Alivia Gaither, Karina Garcia, Zack Gryder, Tyler Harris, Lydia Hopkins, Jordan Hughes, Tyrek Kearney, Kyle Laws, Elliott Martinez, Colby McAlister, Noah Miethe, Darby Mitchell, Hope Morrison, Arianna Munson, Trista Mykins, Amelia Peck, Austin Rash, Victoria Reavis, Jordan Reid, Anna Mae Roark, Olivia Roop, Donald Shoffner, Seth Singleton, Anna Smith, Courtney Stroud, Macey Turant, Anna Wagoner, Zachary Walker, Makayla Wellman, Ethan Yount, and Nehemiah from **Harmony Elementary**, Ryan Gandy and Kay Lauren Rhea from **Sandhills Classical Christian School**, Chloe Carroll from **Shining Light Academy**, Dakota Griffin from **Star-Biscoe Elementary**, and Rebecca Hettrick from **W.D. Williams Elementary**.

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.

Solution: Rebecca Landon, 5th grade, **North Ridge Elementary** (teacher: Mrs. Byrne).

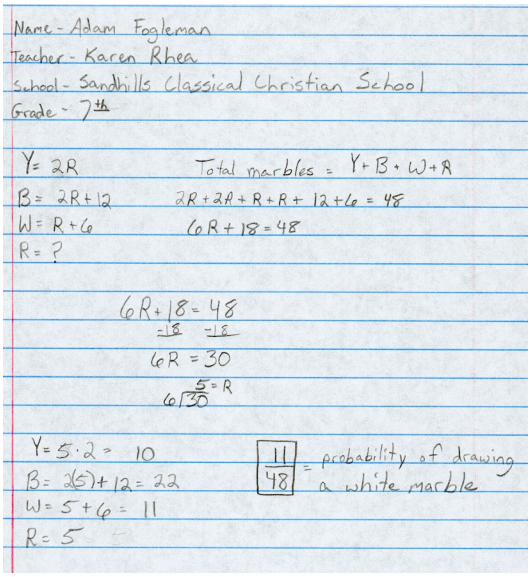


Correct Solutions were received from Tyler Hatch from **Alamance Elementary**, Dylan Hulon from **Galberry Farms Elementary**, Brian Barnes, Aljeanae Broadnax, Johnathan Jackson, Kayla Kreuder, Kristen Murphy, Stephen Pearsall, Daniel Prescott, Taylor Rogister, and River Wilkinson from **Moyock Elementary**, Devin Ayscue, Donovan Collins, Logan Knox, and Rebecca Landon from **Northridge Elementary**, Brittany

Dove, Carlie Estabrook, Madison Lambkin, and Rebekah Martin from **Park View Elementary**, Anne Williams from **Rocky Mount Academy**, Rebekah Cross, Johnny Gandy, Ben Middleton, William Proulx, and Joshua Rhea from **Sandhills Classical Christian School**, Carrie Ann Atkins, Dylan Brown, Hayleigh Clapp, Ethan Cole, Erin Hayes, Nathan Kiser, Cheyenne Madden, Dillon McNeill, Melissa Morales, Jose' Osorio, Jessica Woodell, Amy Wright, and Austin Yow from **Seagrove School**, Corbin Carroll from **Shining Light Academy**, and Nakayla Adams, Soloman Banks, Elizabeth Bautista, Dewayne Brown, Patrick Caffferello, Kaleel Chesson, Megan Daniel, Kristy Eakes, Brittney Evans, Chelsea Farrar, Diane Garcia, Tyra Jenkins, Bennett Jethro, Johnson Little, Andrew Pofahl, Sarah Quinn, Ryan Singh, Ryan Slade, Khyree Stokes, Dylan Styron, Brittney Teel, Erica Whitehurst from **South Greenville Elementary**.

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?



Solution: Adam Folleman, 7th grade, **Sandhills Classical Christian School**, (teacher: Ms. Rhea).

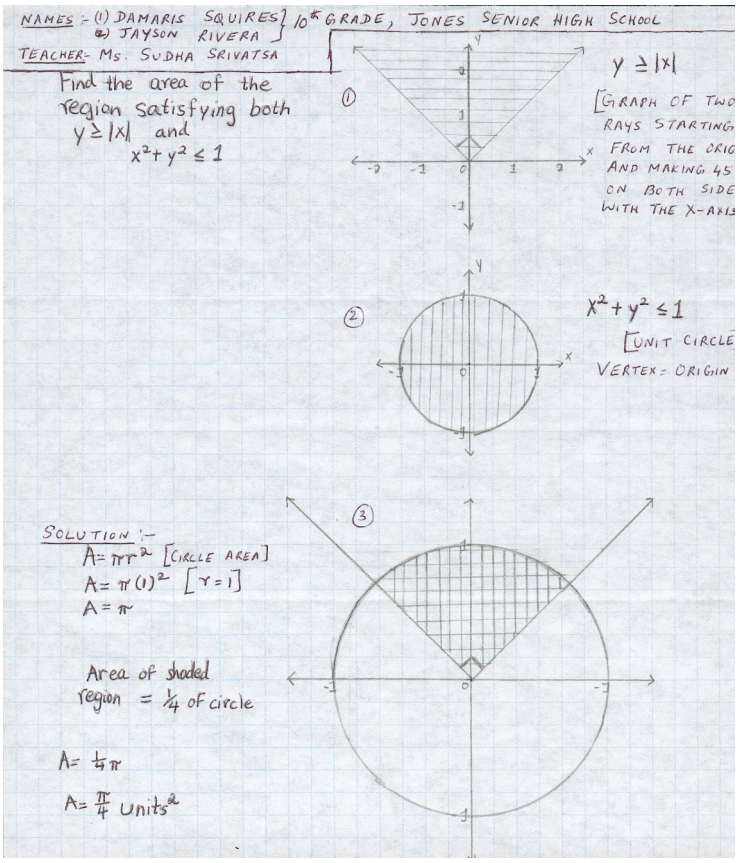
Correct Solutions were received from Kyle Arnold, Tom Jackson, Anne Lucas, Liddy Roer, and Katherine Smith from **Canterbury School**, Courtney Anderson, Michael Laverick, Sabrina Mason, and Miriam Rosen from **Cary Academy**, Faith Beamon, Jacob Bitinas, Sarah Paige Fletcher, Sydney McCauley, Berkeley Tate, and Grace Williams from **Currituck Middle**, Brandi Baker, Aurelio Cazares, Trei Jolly, Melinda Justice, Joseph Martin, April Russell, Aaron Tallman, Caleb Underwood, Matthew Vaughn, and Leah Woods from **East Alexander Middle**, Nicholas Lacombe and Chantrel Reynolds from **Eastern Wayne Middle**, Kate Currin, Ali Denny, Betsy Dickerson, Cody Evans, Chris Hill, Allison May, Ashley McRae, Seth Newton, Chelsea Parker, Gracen Pittard, Lynwood Roberts, Latricia Taylor, Shaniqua Taylor, Patrick Warren, Sara Watkins, Marianna Whitt, Gray Williams, and Kristen Williford from **Northern Granville Middle**, Amanda Johnson, Kevin Powell, and Jacob Ridlon from **Northwest Middle**, Jayme Gillespie, Cameron Smith, Chort Thao, and Bau Yang from **River Bend Middle**, Justin Dearman, Adam Fogleman, Ashley Kidd, and Sami Middleton from **Sandhills Classical Christian School**, Meredith Nichter from **Shelby Middle**, Chance Cockrell from **Southeast Guilford Middle**, Dequante Andrews, Jasmine Barnes, Brianna Barrymar, Chris'ta Bazemore, Tamary Bazemore, Tristian Bazemore, Kayana Belfield, Joseph Bond, Larry Bond, Shakeila Bond, Yashonti Bridges, Chaniece Brown, Trenesa Brown, Angel Bryant, Fontasia Cherry, Norman Cherry III, Quanesha Cooper, Lauren Cuttino, Courtney Dunlow, Jarvis Gilliam, Akiana Glenn, Nikki Harrell, Zachary Harris, Kiara Heckstall, Vincent Holley, Kirk Hutchinson, Chris Jernigan, Jaelyn Johnson, Tameakia Lee, Christian Lilley, Lester Miller, Donna Mizelle, Terri Morris, Zachariah Newkirk, Tiffany Newsome, Jack Nicholson II, Riketta Norfleet, Anthony Outlaw, Jamie Outlaw, Jorie Parker, Quanisha Perry, Sha'Tauga Pugh, Antonio Roscoe, Niki Ruffin, Jyrell Shepperson, Jadale Smallwood, Robert Smallwood, Brittany Smith, Lakeisha Speller, Tyriek Spivey, Equalia Vines, Pearl Vines, Jasmine Ward, Darrius Wesson, Kennedy Wesson, Jerron Wiggins, and Quadedra Williams from **Southwestern Middle**, Alex Averbook, Matthew Friesen, Charlie Johnson, Christopher Mayner, Maura Thornton, and Alex Zhang from **The O'Neal School**, Austin Allen, Brittany Bell, Robert Brown, Brandon

Candy, Sarah Dalton, Rianda Evans, Caroline Gaither, Lucy Goodwin-Johansson, Caleb Haselton, Anna Hill, Grant Huffman, Sara Hurdle, Maddie Johnson, Jin Kim, Joshua Krafft, Justin Lea, Trinh Ngo, Keegan Pace, Travis Poole, Helen Powell, Cassandra Rigsbee, Wahab Sheikh, Ashely Sochor, Laural Strausbaugh, Kayla Trollinger, and Eric Turrentine from **Turrentine Middle**, and Matthew Draelos from **Weslyan Christian Academy**.

Grades 9-12

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

Solution: Jayson Rivera and Damaris Squires, 10th grade, **Jones Senior High** (teacher: Ms. Srivatsa)



Correct Solutions were received from Jayson Rivera and Damaris Squires from **Jones Senior High**, Bolu Adeyeye, Kam Horvath, Marion Mogk, and Megan Trull from **Northwest Cabarrus High**, and Will Blair and Luke Michael Taylor from **Ragsdale High**.

DPI Math Resources on the Web

The website you are accustomed to for DPI mathematics resources is moving. Please check the new site <http://community.learnnc.org/dpi/math/>.

Butterfly Sticker & Homework Recording Sheet

June L. Blackwell[1]
Sanderson High School
Raleigh, North Carolina

Do you love to check and grade your student's daily homework? Do you love to decide whether a student should receive a 1, 2, 3 or check, check plus, check minus on daily homework? Do you have a way to get students to become more responsible for their work and actions? If you answered yes to any of these questions, on the next page is the time saving recording sheet for you!

First, you need to decide a sticker or stamp that you like to see because trust me, you will see it often! I like butterflies, so that is what I use. At the beginning of each class, I walk around the room with my butterfly rubber stamp and inkpad. Students who have completed their homework get a full stamp on their sheet. If they have partially completed their homework, I tilt the stamp and give them half of a stamp, and if they have not done their homework, they do not receive a stamp.

The next section of the recording sheet is for positive re-enforcement. I place a small butterfly sticker on my students' papers when they make 85 or better on a quiz or test. I also use stickers as prizes in review games and for good behavior. The students place the sticker on their recording sheet by covering up the number. This provides a quick reference to see how many stickers they have received when I collect their sheet. At the end of the quarter, I collect the students' pages, and I add the number of sticker points to their lowest quiz grade. This helps to teach the students to work on their grade along the way instead of waiting for the last minute, to miraculously improve their grade.

The next part of the recording sheet is the Quarter Hall Pass. I like for students to take care of their bathroom and locker needs before or after my class. This coupon puts the responsibility on the student. Each box under the Quarter Hall pass section is worth 0.5 points, so if a student needs to use his/her coupon, then I hole punch the 1 pt box leaving the 0.5 pt box. If a student needs to use the pass a second time, then the 0.5 box is punched and no additional points are available to the student for the grading period.

Each year I tell my students I am sure that they have come across a teacher who does not waiver when a student's grade is a few decimal points away from the next higher grade. For instance, a student's grade might be 84.2 and a B starts at 85. By using the coupon method, if a student's coupon is un-punched then they can receive the additional decimal points that they need to push them up to the next grade. Most teachers I know would probably give the student the benefit of the doubt and the next higher grade, but by using the coupon method students become more responsible for taking care of their personal needs.

All three of these recording and classroom management techniques are contained on one sheet of paper, so that when I collect the sheet at the end of each grading period, I have numerous pieces of information at my finger tips for each student. Each year, I tweak and revise my Butterfly Sticker & Recording Sheet. This

[1] *Ms. Blackwell, aka the Butterfly Lady, is a National Board Certified teacher and Kenan Fellow who teaches at Sanderson High School. She also serves as NCCTM Eastern Regional VP for Seconday Schools.*

year, I added additional pieces of information like a section to record grades, Tardy Warning, Character Education traits, and SAT dates. I often put a grade recording section on my class schedule for my Community College classes, so I decided to use the same technique in my high school classes.

I hope this sheet of ideas is helpful and useful in starting the new school year off on a good "wing" – ha ha ha.

Butterfly Sticker & Recording Sheet Ms. June L. Blackwell						Name
Character Education Traits - The Core of Education and Life! *Courage Self-Discipline Perseverance Integrity Respect Responsibility Kindness Good Judgment*						
Date	Sticker	Grade Recording Section				**Quarterly Hall Pass** You May Use This Punch Card Pass for up to Two (2) Trips During a Quarter: Bathroom Locker Water Other Un-punched boxes may be redeemed for up to 1 pt added to your Quarter Grade. 1.0 0.5 This pass May Not be sold, traded or given Away! The **Management** reserves the right to deny you a pass!!!
	1	UT	Quiz	Project	EC / Stickers	
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
Total						SAT Dates 11/1, 12/6, 1/24, 3/27, 5/1, 6/5

Write the Daily Homework Assignment & Date in each box.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	Total Number of Butterfly Homework Stamps

Tardy Warning Hole Punch

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
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.

NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS

BOARD OF DIRECTORS

Office	State	Eastern	Central	Western
President	Jeane Joyner Raleigh	Julie Kolb Raleigh	Emogene Kernodle Elon	Carmen Wilson Deep Gap
Past President	Jan Wessell Wrightsville Beach	Kathryn Hill Raleigh	Vickie Moss Asheboro	Betty Long Boone
Secretary	Tery Gunter Durham	Elizabeth Murray Leland	Angela Flowers Sophia	Cindy Robinson Boone
Vice President Colleges	Susan Friel Chapel Hill	Gail Stafford Rocky Mount	Cos D. Fi Greensboro	Terry Rose Knoxville (TN)
Vice President Elementary	Wendy Rich Asheboro	Carolann Wade Cary	Sylvia Davis Asheboro	Debbie Ross Asheville
Vice President Middle Grades	Sandra Childrey Cary	Lucy Kay Raleigh	Karen Ellis Greensboro	Kim Tyson-Aiello Granite Falls
Vice President Secondary	Tony Sapp Swannanoa	June Blackwell Raleigh	Elaine Tucker Pinehurst	Kim Daily Swannanoa

SPECIAL SERVICES

Centroid
Brian Felkel &
Holly Hirst
Boone

Convention Services
Richard Haworth
Elon

DPI
Bill Scott
Raleigh

Development
Robert Jones
Raleigh

Financial Advisor
Ronald Hann
Greensboro

Historian
Kathryn Hill
Raleigh

Innovator Award
Philip Johnson
Charlotte

Logo Contest
Rebecca Caison
Raleigh

Management Services
Anne Palmer &
William Palmer
Salisbury

Minigrants
Phyllis W. Johnson
Greenville

Math Fair
Betty Long
Boone

Math Contests
John Goebel
Durham

NCTM Rep.
Betty Long
Boone

NCSSM Rep.
Wali Saleem
Chocowinity

Nominations
Jan Wessell
Wrightsville Beach

Parliamentarian
Robert Joyner
Greenville

Rankin Award
Robert Joyner
Greenville

Student Awards
Gilbert Casterlow
Greensboro

Trust Fund
Bill Paul
Sugar Grove

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:		_____

Payment by ❑ Check ❑ Visa ❑ MasterCard

Card # _____

Exp. Date _____

Signature _____

Please make your check or money order payable to NCCTM. Send this form and your payment to
NCCTM
PO Box 1783
Salisbury, NC 28145-1783
Payments by credit card may be mailed or faxed to
704-642-0840