REFLECTIONS

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52nd GEORGIA MATHEMATICS CONFERENCE

More Than Meets The Eye

Author Guidelines

Manuscript Format: Manuscripts are blind reviewed by members of the editorial review board. For this reason, each manuscript should include a cover sheet containing: title of manuscript, author's name, position and email address. Identifying information should not appear elsewhere in the manuscript in order to ensure an impartial review.

Manuscripts should be double-spaced, with 1-inch margins on all sides, typed in 12-point font and follow the APA 6th Edition style guide. Manuscripts should be submitted in MS Word. If you have a picture or graphic in the text, please include the original picture(s) in a separate file.

Manuscript Submission: Manuscripts should be submitted to Cheryl Hughes, hughesgctm@yahoo.com. Receipt of manuscripts will be acknowledged. Manuscripts are accepted for consideration with the understanding that they have not been published previously and are not being considered simultaneously for publication elsewhere.

Manuscript Publication: When a manuscript is accepted for publication, the editor/journal reviewers may make suggestions or revisions in consultation with the principal author. However, because of publication deadlines the editor reserves the right to make minor revisions without seeking prior approval from the author. Release statements for all copyrighted materials must be received prior to publication.

REFLECTIONS

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President's Report

by Debbie Poss
President
deborah.poss@cobbk12.org

One more summer is coming to an end and we find ourselves back in the classroom again. Hopefully we are refreshed, energized and ready to do our best to empower our students to do their best.

Our school just got a new computer operating system this summer and once again, I'm in "student mode." That means I am struggling to find older familiar operations, while discovering what the new features will do. At first I grumble that "the old operating system worked fine, so why do we need a new one", but then I begrudgingly realize that once I figure out the logic and shortcuts the new system really is better. Hopefully, you have come to realize the same is true of the GPS curriculum, because the CCGPS is coming out next year and we will be making slight modifications in the curriculum again.

Just to keep you posted on the details:

- The CCGPS Mathematics Teaching Guidelines and Overviews for Grade Levels and High School are posted on the DOE website, gadoe.org. (In July, to see this you needed to go to gadoe.org, click on Educators, then Curriculum and Instruction, and then Mathematics.) The grade level standards, overviews, and teaching guidance documents are posted in the Learning Village, on georgiastandards.org (go to the Common Core GPS tab), and on the mathematics program page at http://public.doe.k12.ga.us/ci_services.aspx?PageReq=CIServMath.
- Support documents should also now be posted under the CCGPS tab on this same math program page.
- The DOE is working on a third document to include both explanations and examples of the standards that should be coming out in the fall of 2011.
- Superintendent Barge and his staff will present an overview of the CCGPS on September 21, 2011 from 3-4 PM on GPB TV. More detailed information on specific grade levels will be televised during February and March.
- GCTM is partnering with several other groups to provide additional training, both during the 2011-2012 school year and during the summer of 2012. Keep checking gctm.org for more details.

Basically our charge this year is to read and discuss the breadth and depth of the CCGPS. Note which concepts will remain the same, which will be taught in more depth and which have been moved to another course. Remember that Sandi Woodall, (Mathematics Program Coordinator at the DOE) swoodall@doe.k12.ga.us has monthly webinars, which are accessible at the georgiastandards.org homepage or by following the link: http://elluminate.gavirtualschool.org/doe/. Recordings can be accessed athttp://elluminate.gavirtualschool.org/doe/recordings.html?s=1310356800000&e=1310443199999 If you sign up for her monthly newsletters, they are on hold for right now. However, the sign up will add the educator's email address to Sandi's listserve for notifications of upcoming webinars and recently added resources.

On another note, my heart goes out to all the ethical teachers in the Atlanta Public School System as well as to all teachers falsely implicated in any teaching and/or testing scandal. GCTM recognizes that cheating is a serious offense and, as teachers in a state which mandates character education, we have a responsibility to "PET" and "PERM" our students. That means we need to "Promote Ethical Thinking" and "Provide Excellent Role Models". It is our opinion that administrative pressure coming from the "No Child Left Behind" legislation and similar edicts has made some teachers loose sight of those character goals and that this pressure must stop. Teachers and administrators must acknowledge that a student's work should be just that, the student's work. To alter that work is to deny a student the pride and responsibility for his/her own knowledge and education. Furthermore, misrepresenting student success sets up subsequent teachers for failure as they attempt to build on a shaky foundation. We might consider ourselves mathematics educators, but we teach way more than mathematics - whether we like it or not. Students learn from our character as well as our instruction, and administrators need to remember that as well.

Professional development is also an important aspect of a teacher's responsibilities. One great professional opportunity can be found at the Georgia Mathematics Conference at Rock Eagle on October 19-21, 2011. With a theme of "Mathematics, More than Meets the Eye", we have an excellent program planned.

- Harvey Mudd Professor, Arthur Benjamin, Thursday's keynote speaker, is called "America's Best Math Whiz" by Reader's Digest, and blends mental mathematics with a little magic to engage, amaze, educate and entertain.
- Friday's keynote speaker, David Hammett not only teaches mathematics at Oakwood School in North Hollywood, but is also the mathematical consultant for many game shows, including "Greed", "The Weakest Link" and "Minute to Win It". Come hear about a truly fascinating application of mathematics.
- Lou Ann Lovin, professor at James Madison University, is Co-Director of the Center for STEM Education and Outreach. As co-author of the Van De Walle Professional Mathematics Series, "Teaching Student-Centered Mathematics", she will help us understand the art of learner centered mathematics.
- Other featured speakers include renowned author David Swartz, and mathematical historian Sloan Despeaux.
- There will be 5 different presentations from the DOE on the CCGPS.
- An "integrating math and science" strand will show tasks to help answer that question, "When will I ever use this".
- Another strand, planned in conjunction with the Georgia Association for Advanced Placement Mathematics Teachers will benefit AP Calculus and AP Statistics teachers.
- Many other great sessions are planned to help classroom teachers grow professionally.

I hope to see you all at Rock Eagle on October 19-21, 2011. And may your 2011-2012 school year be the best one yet!

Executive Director's Report

by Tom Ottinger
Executive Director
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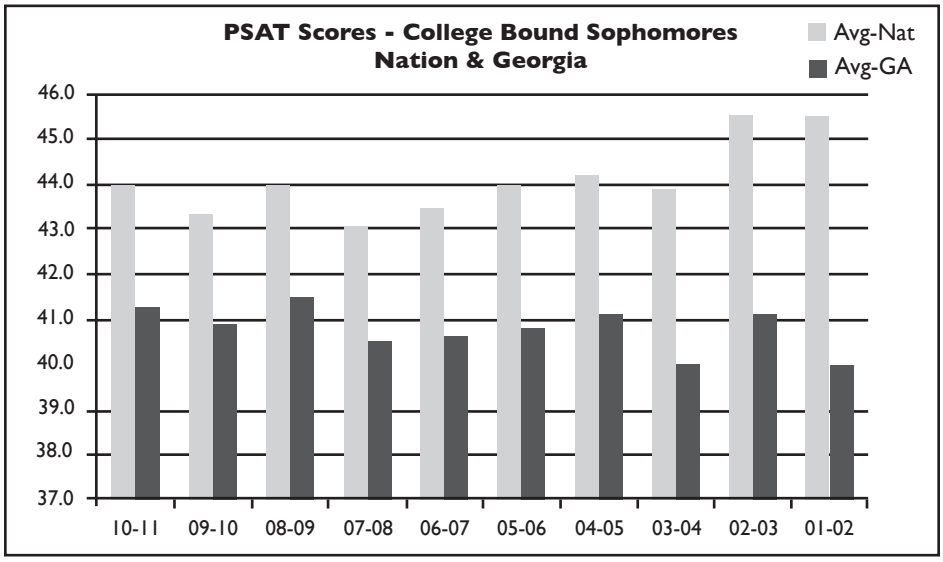
According to Georgia House Education Committee Chair Brooks Coleman, both his committee and State School Superintendent John Barge want to move toward more local control of education. That was a major part of the Superintendent's rationale for offering school districts a choice of integrated or separated courses for high school mathematics. As far as I know, there has been no announcement about how high school courses will be organized when the Common Core State Standards are implemented beginning in 2012-13, but it seems very likely that the choice of integrated or separated mathematics courses for high school will continue.

What are the implications of this for GCTM? First, we need to encourage the DOE and school districts to record student performance data under both the integrated and separated curriculum organizations. Second, we need to be sure that analyses of these data are disseminated statewide so that school systems can make informed choices regarding which path is best for their students. Third, we need to do our best to support *both* pathways through the Georgia Mathematics Conference, *Reflections*, and professional development academies.

As things stand now the integrated approach seems to be working, but getting people to believe that can be difficult. I've heard several comments alleging that the GaDOE manipulates passing scores on the High School Graduation Test and End of Course Tests to make student performance look good. For the skeptics among you, the graphs below show Georgia student performance on the College Board's PSAT. The data came from the College Board itself (http://professionals.collegeboard.com/data-reports-research/psat/). Students in private, parochial, and home schools are included, but they account for a small percentage of Georgia students and there is no reason to believe that their performance should have changed substantially from one year to the next.

Note: Almost all Georgia students take the PSAT as sophomores, so the data for all of the years above are likely to include students who do not plan to attend college.



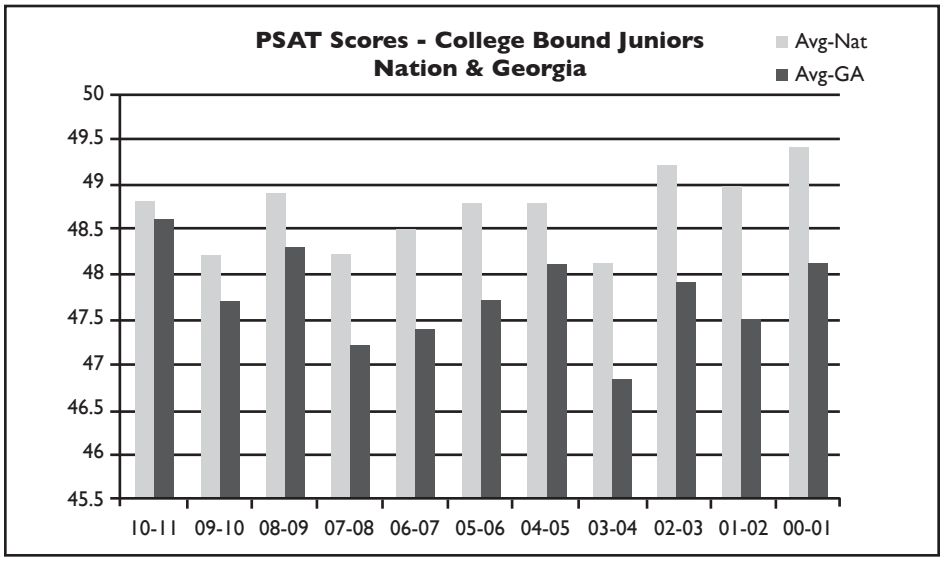
Here are a couple of items worth noting from the graph above:

The average PSAT score for Georgia sophomores in 2010-2011 (students who have completed Math I) is ***higher*** than it has been in seven of the previous eight years of Algebra I (01-02 through 08-09).

GCTM NEWS

2009-10 was a learning year for both teachers and students. Even so, the average PSAT score for Georgia Sophomores in 2009-2010 (students who have completed Math I) is ***higher*** than it has been in five of the previous eight years of Algebra I.

PSAT data for juniors show similar gains. See the graph below.



Cheryl Hughes
Incoming Editor
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GCTM is Going Digital!

In an effort to embrace the 21st Century, REFLECTIONS is going digital for the 2011-2012 school year. Our newsletter--dubbed *eReflections*--will be published exclusively online. This green, paper-saving format will utilize technologies here tofore impossible in print. Every issue will contain announcements, helpful hints and educational articles that Georgia mathematics teachers have come to appreciate. Additionally, articles will be available in convenient and user friendly PDF format that can be printed as necessary. Interactive pages and online "hot" links will take our publication to a new and unprecedented level.

The first edition of *eReflections* will be ready by Labor Day and you will be informed via email. Follow the link in the email to our new format packed with changes and innovations!

So join us in celebrating technology and just imagine the places we can go!

Membership Report

by Susan Craig
Membership Director
secddc@aol.com

GCTM Membership Notes

GCTM membership rosters show 2710 active members. Membership numbers by region are summarized below.

North West	226
North East	300
Metro West	423
Metro East	418
Central West	331
Central East	531
South West	265
South East	200
Out of State	16
Total Membership	2710

⇒ Thank you for helping to keep the database accurate. YOU can enter address and personal data changes on our website www.gctm.org

⇒ Student memberships expire on June 30. Student members who retain fulltime student status and have never taught professionally should renew your free membership online now. Graduating student members, who are beginning your teaching careers, are encouraged to join GCTM as active members. This may be completed online. Membership is $20 per year. Membership is included in Georgia Mathematics Conference registration. New teachers might wait to join at that time.

⇒ Current and departing student members are urged to visit the website www.gctm.org and update email and snail mail addresses. We want information to reach you as you transition into career mode or move your residence.

⇒ Fulltime graduate students who have taught professionally in the past, but are not currently employed as teachers, are offered a $10 rate for GCTM membership.

We have been saddened to learn of the passing of a longtime GCTM life member, Heyward Thomas of Atlanta.

Please share any ideas you have of new benefits or programs, which GCTM can offer you as members. Have a restful and invigorating summer!

Metro-East Report

Leanne Luttrell

I hope to see all the metro east region members at the conference! Is anyone interested in having a regional meeting sometime in January or February? What are some topics you would like to discuss? If you have ideas, please let me know. Also, please do not hesitate to email me with information regarding awards or other news. I would like to share them in the regional reports! My email is Leanne_Luttrell@gwinnett.k12.ga.us. I look forward to hearing from you!

Southwest Report

Jason F. Williams

Greetings from Southwest GA!!! My name is Jason F. Williams, and I currently serve as the Southwest Region Representative for GCTM!! I am looking forward to working for you on the GCTM Board to make your life easier as mathematics teacher in the state of Georgia.

Summer is a great time to reenergize yourself as a teacher and prepare for the upcoming year that will bring new students and new opportunities along with new and old obstacles. With our current students now surrounded with technology, it is important for us to use technology in our classrooms as well as allow them opportunities to use technology to gain mastery of the standards.

Georgia Virtual Learning (www.gavirtuallearning.org) is a great resource for teachers and students throughout the state of Georgia. GA Virtual Learning consists of Georgia Virtual School (www.gavirtualschool.org) and Georgia Credit Recovery (www.gacreditrecovery.org).

GA Virtual Learning is the new wave of education throughout the state of Georgia. Test scores show students perform better on most EOCTs when taking the course online rather than in the traditional classroom. In an effort to assist teachers in teaching the concepts and experience what students encounter in an online course, there are courses available for teachers to use with their students or simply use to gain additional ways to teach the concepts. At the GA Virtual Learning website under resources, Math 1 and 2, English 9 and 11, and Biology courses are available for teachers and students to use. This is a great supplement for teachers and students in these courses. GA Virtual Learning also offers free access to over 50 of GaVS's courses for schools wishing to have these great resources for their students.

GA Virtual School is a great opportunity for students to take courses in an online setting. Rural Georgia schools as well as urban schools can now offer their students a much wider selection of courses in addition to the classes they offer in their school. The complete list of courses offered can be found online, and most courses have the option of completing the first semester (A), second semester (B), or the full course (AB).

GA Credit Recovery allows schools the opportunity to recover math (and other subject) credits they may not have gained due to failing the course for some reason. GA Credit Recovery is a free option for students to use in order to regain failed credits. This is a great opportunity for students to become ready for graduation due to them recovering their missing credit/s.

As a teacher in a traditional classroom and at Georgia Virtual School, I recognize the importance of options for both teachers and students. Online learning is a growing trend throughout the state of Georgia and nation. I encourage each of you to take some time to view the websites listed above in order to benefit yourselves and your students.

I look forward to seeing each of you at the upcoming Georgia Math Conference. This is a great time to see what other teachers and schools are doing to educate our students in the great field of mathematics!!!

Enjoy your summer break and let me know if I can assist you!!

Regional Reports

GCTM NEWS

Northeast Report

Kay Haugen

AMDM

Advanced Mathematical Decision Making (AMDM) is one of the 4th year options available for Georgia high school math students who have successfully completed Math I, Math II and Math III. This course includes a wide range of mathematical topics that should prove very interesting for students. Some of the topics include network graphs, aspect ratios, applications of statistics and probability, and various finance applications such as the effect of compound interest on both investments and credit. Students who take this class will apply the math learned in Math I, II and III to justify and explain mathematical decisions that they make.

This course, developed by the Charles A. Dana center at the University of Texas at Austin in partnership with the Texas Association of Supervisors of Mathematics, is going to be a great option for many of our seniors. I was privileged to be among the teachers from across the state who gathered in Atlanta in June for training in teaching this course. Many of the teachers, instructional coaches and RESA math mentors who attended this training are committed to redelivering the training in their respective regions or school districts. The northeast Georgia teachers who attended will hold a week of training July 16-20. Teachers can register to attend through the Northeast Georgia RESA website.

Even if you aren't going to be teaching AMDM in the 2011-2012 school year, you can benefit from the training. Seeing and participating in the application of the process standards of problem solving, reasoning, communication, connections and multiple representations will help you to implement these process standards in your classroom, regardless of the mathematical content you teach. As you work through the examples from the AMDM curriculum, you will discover ways to help students make connections among the various strands of algebra, geometry and statistics that we teach in high school mathematics.

Professional Learning Communities

Within in the Northeast Georgia RESA community of math teachers, professional learning communities in high school mathematics, AP Statistics and AP Calculus will continue. It will be very beneficial for us to stay connected as we prepare to make the transition from GPS to Common Core. I will get you the specific contact information for the group in which you are interested if you will contact me at haugenk@clarke.k12.ga.us.

Rock Eagle

Please make plans to attend the region meeting during your trip to the Georgia Math Conference at Rock Eagle this October. The other northeast Georgia region rep, Kate Arnold, and I look forward to meeting you and discussing ways that we can better serve you. Kate is a great contact if you have ideas or concerns regarding K-5 math instruction. She can be reached at arnoldk@clarke.k12.ga.us.

Reflections Purpose

Reflections, an official publication of the Georgia Council of Teachers of Mathematics, serves as a resource to inform the membership of Council activities and provide resources to enhance the teaching and learning of mathematics in Georgia.

GCTM 2011 Middle School Mathematics Competition

by Chuck Garner
VP for Competitions
cgarner@gctm.org

Middle School Mathematics Competition

The GCTM Middle School Math Tournament was held at Thomson Middle School in Centerville, GA on April 23, 2011. Middle schools across the state were invited to register up to eight students to compete. The tournament consisted of a 30 question multiple-choice test with a 45-minute time limit; 10 individual ciphering problems, each problem with a two-minute time limit; 3 rounds of four pair ciphering problems (in which students from a school formed teams of two), each round with a four-minute time limit; and a four-person team "power question," in which the team solves a complex problem with a 10-minute time limit.

The tournament is designed to challenge middle school students and to reinforce classroom skill. However, we also make sure the students have fun! At the conclusion of the tournament, students participate in a fun-only "Frightnin' Lightnin'" Round, where students must be quick on the draw to answer math problems posed orally. The winners of this round get candy!

Trophies went to the top five teams and the top ten individuals. The top teams are below.

TOP 5 TEAMS:
Dodgen Middle School
First Presbyterian Day School
Tattnall Square Academy
Inman Middle School
Greater Atlanta Christian School

Ninety-one students from sixteen schools participated. Sponsors that are members of GCTM only had to pay a $10 registration fee *or* submit five multiple-choice questions for possible inclusion in a future tournament. The next GCTM middle school tournament is scheduled for April 21, 2012.

Below are some sample problems from the tournament.

Test Problem #12: Two different primes, each less than 100, are multiplied. What is the greatest possible product of these two primes?
a) 8463 b) 8633 c) 8827 d) 9021 e) 9603

Test Problem #29: A fruit basket contains 5 apples, 4 oranges, and 6 pears. You pick some fruit one-at-a-time at random without replacement. What is the probability that you select one apple, one orange, and one pear in that order?
a) 1/225 b) 1/120 c) 8/225 d) 4/91 e) 1/15

Individual Ciphering #8: A cube whose side lengths are each 100 cm is cut into smaller cubes of side length 5 cm. How many smaller cubes will there be?

Pair Ciphering #2: When 54 is multiplied by the positive integer k, the result is a perfect square. What is the smallest value of k?

Answers: B; D; 8000; 6

GCTM State Math Tournament News

by Chuck Garner
VP for Competitions
cgarner@gctm.org

The 35th annual GCTM State Math Tournament was held at Macon State College in Macon GA on April 30, 2011. Schools are invited to the state tournament based on their performance on previous Georgia tournaments throughout the 2010-2011 school year. Thirty-two invited schools attended this year's state tournament. Four students are selected to represent each school. Thirty individuals were also invited to try-out for the state-wide Georgia ARML team, making a total of 158 participants.
The tournament consisted of a very challenging written test of 45 multiple-choice questions and 5 free-response questions with a 90-minute time limit; 10 individual ciphering problems, each problem with a two-minute time limit; and 2 rounds of four pair ciphering problems (in which students from a school formed teams of two), each round with a four-minute time limit.
The tournament was held with the assistance of the Mathematics Department at Macon State University, as well as the financial assistance of two grants from the Macon State College Foundation and AT&T Georgia.
Last year GCTM inaugurated the Steve Sigur Award for Most Improved Performance. The award, named in honor of the great mathematician, teacher, and mentor Steve Sigur, this year went to Ksenia Zakirova of Rockdale Magnet School.
Trophies also went to the top five teams and the top ten individuals. The winners are listed below.

TOP 5 TEAMS:
Northview High School
Walton High School
Chamblee Charter High School
Alpharetta High School
Wheeler High School

TOP 10 INDIVIDUALS:
Sitan Chen, Northview High School
Claus Zheng, Walton High School
Allen Park, Walton High School
Nathan Corbin, Alpharetta High School
Anchen Yao, Parkview High School
David Xing, Northview High School
Tim Wu, Parkview High School
Monica Agrawal, Chamblee Charter High School
Mike Wang, Gwinnett School of Math, Science, and Technology
Grant Carlson, Westminster

State Tournament registration is free, but schools must be invited. The next GCTM State Mathematics Tournament is scheduled for April 28, 2012.

Below are some sample problems from the state tournament.

Test Problem #19: Let a, b, c, d, and e be positive integers such that $a\ d \bullet b\ d \bullet c\ d \bullet d\ d \bullet e$. Suppose $\{a, b, c, d, e\}$ has mean 12 and range 18, while the mode and median are both 8. Determine the number of possible values for d.
a) 2 b) 3 c) 4 d) 5 e) 6

Test Problem #28: Compute the number of perfect cubes that are divisors of the product 1!2!3!4!5!6!7!8!9!.
a) 40 b) 81 c) 110 d) 220 e) 324

Test Problem #42: The length of the longer base of a trapezoid is 97. The length of the segment connecting the midpoints of the diagonals of the trapezoid is 3. Find the length of the shorter base of the trapezoid.
a) 97/3 b) 97/2 c) 91 d) 93 e) 94

Individual Ciphering #5: For how many integers n is the difference between the cube root of n and 4 less than 1?

Answers: E; D; C; 97

GCTM NEWS

Georgia ARML Team Among Best in Nation

by Chuck Garner
VP for Competitions
cgarner@gctm.org

The 36th annual American Regions Mathematics League (ARML) tournament took place at UGA on Saturday, June 4. The Georgia ARML "A1" team finished 10th in the nation in the A division and the Georgia ARML "B1" team finished 7th in the nation in the B division. This marks the 22nd consecutive year that the Georgia team finished in the top 10% at the "world series" of math team tournaments. Additionally, team members Edward Park from Walton High School placed 13th and Tim Wu from Parkview High School placed 16th. They both received plaques, software, and cash prizes.

Held simultaneously at four sites around the nation (Pennsylvania State University, University of Nevada at Las Vegas, University of Iowa, and University of Georgia), this competition attracted 138 teams comprising over 2000 students from all over the U.S. as well as Canada, China, Macau, Singapore, and the Philippines. Any geographically contiguous region may enter as many 15-person teams as it likes, whether that region is as small as a school district or as large as a state, as long as regions do not overlap. For the first time, Georgia fielded four teams of 15 (plus an alternate, for a total of 61 students). Students are selected based on results from the state tournament, AMC scores, AIME scores, and winning scores at other Georgia tournaments. The Georgia A1 and A2 teams are made of up experienced ARML participants, while the Georgia B1 and B2 teams are considered "training" teams made up of promising newcomers to ARML.

The ARML tournament brings together the nation's finest students, where they meet, compete, and socialize, forming friendships and sharpening their mathematical skills. The contest is written for high school students, although some highly-talented middle school students attend each year.

The tournament consists of four rounds. The Team Round is first, in which the 15 teammates have 20 minutes to solve 10 problems. Next is the Power Round, in which the team has 60 minutes to write proofs to complex, multi-part problems. This year's Power Round topic involved proving statements concerning Pascal's triangle, Clark's triangle, and Leibniz's harmonic triangle. Next is the only round that is not team-oriented, appropriately called the Individual Round. For this round each student solves 10 problems independently. However, the students receive the problems two-at-a-time with a time limit of 10 minutes per pair of problems. After a lunch break is the final round, the Relay Round. The 15 teammates form five relay teams of three each, where one person's answer is used in the next person's problem.

National sponsorship of ARML is mainly provided by the D. E. Shaw Group, an investment and technology development firm. Other national sponsors include the American Mathematical Society, Art of Problem Solving, Key Curriculum Press, Math League, Mu Alpha Theta, Texas Instruments, and Wolfram Research. Locally, sponsorship of the Georgia ARML teams is mainly provided by GCTM.

Coaches of this year's Georgia ARML team were Angelique Allen (Greater Atlanta Christian School), Tom Fulton (Walton High School), Chuck Garner (Rockdale Magnet School), Henry Oglesby (Creekview High School), Debbie Poss (Lassiter High School), Carol Sikes (South Forsyth High School), and Head Coach Don Slater (Lassiter High School). Joining the coaching staff this year were five former Georgia ARML participants: Jacob Rooney, currently a student at UGA; Miles Dillon-Edwards, currently at Indiana University; and Harrison Brown, Jonathan Johnson, and Santhosh Karnik, all three currently students at Georgia Tech.

The members of the outstanding 2011 Georgia ARML team are listed below with their school and grade.

Abubakar Abid, Walton High School, 12
Moncia Agrawal, Chamblee High School, 10
Jonathan Austin, Northview High School, 11
Shivani Baisiwala, Walton High School, 11
Udai Baisiwala, Walton High School, 9
Emory Brown, Greater Atlanta Christian, 11
Grant Carlson, Westminster, 11
Slok Carpenter, Walton High School, 11
Gautam Chebrolu, Columbus High School, 10
Brandon Chen, Chamblee Charter High School, 10
Nicholas Chen, Chamblee Charter High School, 10
Ryan Chen, Crews Middle School, 8
Sitan Chen, Northview High School, 11
Lilly Chen, Westminster, 10
Nathan Corbin, Alpharetta High School, 11
Andrew Couch, Lassiter High School, 11
Sean Dai, South Forsyth High School, 10
Ryan Dickmann, Columbus High School, 10
Val Felso, Soli Deo Gloria Homeschool, 12
Timothy Gieseking, Sculley Homeschool, 7
Gil Goldshlager, Walton High School, 10
Nolan Hackett, Walton High School, 12
Michael Hopkins, Pace Academy, 12
Richard Hu, Chattahoochee High School, 10
Denny Jin, Walton High School, 11
Tim Kierzkowski, West Forsyth High School, 12
Heeyoon Kim, Rockdale Magnet School, 10
Kyung Kim, Northview High School, 11
Jonathan Li, Duluth High School, 10
Michael Liang, Northview High School, 9
Wayne Lu, Wheeler High School, 11
Sina Monfared, Wheeler High School, 9
Sophie Mori, Walton High School, 9
Vijeth Mudalegundi, South Forsyth High School, 10
Arvind Narayan, Northview High School, 11
Allen Park, Walton High School, 12
Edward Park, Walton High School, 9
Anath Punyala, Alpharetta High School, 11
Tony Qian, Northview High School, 10
Jeremy Rachels, Rockdale Magnet School, 9
Sneha Sareedy, Wheeler High School, 10
Edward She, Lakeside High School (Evans), 9
Roger Song, Walton High School, 10
Yubo Su, Northview High School, 11
Anirudh Tadanki, Milton High School, 10
Kelsey Tjen, Columbus High School, 10
Andrew Tsao, Chamblee Charter High School, 10
Richard Wan, Milton High School, 12
Charles Wang, Walton High School, 11
Mark Wang, Gwinnet School of Math, Science, and Technology, 9
Michael Wang, Walton High School, 10
Mike Wang, Gwinnet School of Math, Science, and Technology, 9
Peter Woolfitt, Chamblee Charter High School, 12
Tim Wu, Parkview High School, 12
Jiyang Xie, Roswell High School, 11
David Xing, Northview high School, 9
Anchen Yao, Parkview High School, 10
Ksenia Zakirova, Rockdale Magnet School, 12
Sam Zhao, Chattahoochee High School, 9
Claus Zheng, Walton High School, 11

Below are some sample problems from this year's ARML tournament.

Individual Round Problem 8: The quadratic polynomial $f(x)$ has a zero at $x = 2$. The polynomial $f(f(x))$ has only one real zero at $x = 5$. Compute $f(0)$.

Team Round Problem 9: Given a regular 16-gon, extend three of its sides to form a triangle none of whose vertices lie on the 16-gon itself. Compute the number of noncongruent triangles that can be formed in this manner.

Relay Round 1 Problem 2: Compute the number of positive integers b such that the number 41 has exactly digits when written in base b.

2011 GCTM Conference

52nd GEORGIA MATHEMATICS CONFERENCE
More Than Meets The Eye

Don't miss out on the magic of this year's conference which will once again be held at the beautiful Rock Eagle 4-H Conference Center in Eatonton, GA. Mark your calendars now for Wednesday, October 19th Friday, October 21st. Be ready to experience the fun of learning, share the passion for teaching, and experience the magic of Mathematics through opportunities that happen once a year at this amazing event. For up to date information on the conference schedule, registration, and how you can become part of this year's magic, be sure to check out www.gctm.org . **Here is some information on this year's amazing keynote and featured speakers that you will not want to miss!**

LouAnn Lovin

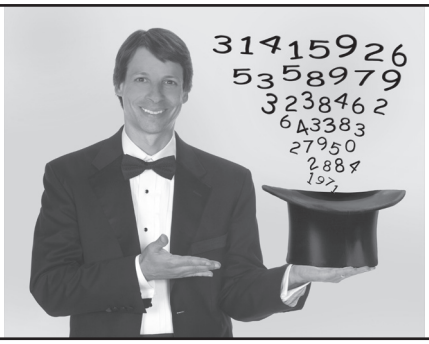
Wednesday Keynote: "Learner Centered Mathematics Teaching: It's More than Meets the Eye

Dr. LouAnn Lovin is a former classroom teacher and is currently an Associate Professor in Mathematics Education at James Madison University. She serves as Co-Director in the Center for STEM Education and Outreach. LouAnn also teaches mathematics methods and mathematics content courses for Pre-K-8 prospective teachers and is involved in the mathematical professional development of teachers in grades K-8. She is co-author of the Van de Walle Professional Mathematics Series entitled "Teaching Student-Centered Mathematics".

Arthur Benjamin

Thursday Keynote: "Mathemagics"

Friday Sessions: "Secrets of Mental Math" and "More Secrets of Mental Math"



Dr. Arthur Benjamin is both a professor of mathematics at Harvey Mudd College and a magician. He has combined his two loves to create dynamic presentations where he demonstrates and explains his secrets for performing rapid mental calculations faster than a calculator. Dr. Benjamin has appeared on many media outlets including: The Today Show, The Colbert Report, and National Public Radio. He has been profiled in publications such as The New York Times, Scientific American, Discover Magazine, and People Magazine just to name a few. Reader's Digest calls him "America's Best Math Whiz". Arthur Benjamin's enthusiasm for mathematical concepts and principles is contagious.

Information

David Hammett

Friday Keynote: "Mathematics and Game Shows"

David Hammett is a high school mathematics teacher and department chair of the Oakwood School in North Hollywood, CA. He was a teacher at South Cobb High School in Austell, GA from 1983 to 1997. He has applied his love of mathematics to his passion for television game shows by working as a mathematical consultant for several popular shows, including "Greed," "The Weakest Link," and "Minute to Win It."

David Schwartz

Thursday Sessions: "Math Happens When Children Wonder", "The Magic of Millions: Exploring Big Numbers Across the Curriculum"

David Schwartz is an accomplished author and storyteller who is an innovator in presenting mathematical information in engaging ways, using humor and a wealth of visuals to inspire and inform. He spends much of his time finding unusual, whimsical ways to make math and science come alive for kids and teachers. He has authored nearly 50 mathematics and science books for children including "How Much is a Million?" and "G is for Googol: A Math Alphabet Book".

Sloan Despeaux

Thursday and Friday Sessions: "Mathematics and Poetry: More Connections than Meets the Eye", "The Pythgorean (?) Theorem: More Than Meets the Eye", "The First Attacks on a 'Man-Eating Problem': A History of the Four Color Problem"

Dr. Sloan Despeaux is an Associate Professor of Mathematics at Western Carolina University in Cullowhee, North Carolina. Besides teaching a wide range of mathematics courses, she teaches courses in the history of mathematics and an upper-level perspective on the history of the Scientific Revolution. Her research interests include nineteenth-century mathematics, mathematicians, and scientific journals in Britain. She organizes a biennial undergraduate conference on the history of mathematics called SMURCHOM (the Smoky Mountain Undergraduate Research Conference on the History of Mathematics). She has recently published in Historia Mathematica, Annals of Science, and Notes and Records of the Royal Society of London.

Teaching Tip

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Why You MUST Do Application Problems - - - and Five Steps to Help Get the Most Out of Each One

Let's just face it - - - teachers often avoid word and application problems in the classroom, and there are lots of reasons. One of those reasons is that it is difficult to get students to understand what the problem is about, and, in the pressure of teaching all of the required content, teachers are acutely concerned about time. They realize that, if they spend five minutes trying to get students to understand an application problem, they won't make the progress they need to make, and even five minutes may not be enough for students to "get" what is going on in the problem. A teacher may try to provide extra explanation - - drawings, charts, photographs, etc. - - so that most students will finally figure out, "Oh! Now I see what is going on." Then what happens? The problem is worked as written, and teacher and students move on.

Perhaps if we got **more mileage** out of application problems, we might use more of them. The purpose of this article is to convince you of the incredible importance of application problems and then to convince you that there is a way to get a lot more out of a problem so that the time spent really pays off for students - - and for you.

The first part of this article: Convincing you that application problems are incredibly important. (If you don't believe this part, you won't buy the next part either.)

Making Mathematics Memorable

In studying how the brain learns, we find that the brain loves a story, and that stories make memories. In elementary school, application problems are called "story problems," and they are no less so in middle and high school. They are still story problems, and at every level, the story can stick in the brain and can make the mathematics memorable.

Making Mathematics Make Sense

The problem avoiding or giving short shrift to application problems is that, for most students, these applications are their one shot at making sense of the mathematics. Many students are not abstract thinkers, especially at earlier levels, and only when they see the mathematics applied does it begin to make sense.

I can't recall the name of the speaker who shared this analogy about applications of mathematics, but it is so true: Suppose I ask you to hang your coat in a closet, but when you open it, there are no hooks, no nails, no bar, and no hangers. You can try hanging your coat, but it will fall to the floor. The same is true for mathematics. If I teach you mathematical computations and you have no reality on which to hang them, they will fall to the floor. For the majority of students, the computations will not make sense, and the retention level is then very low.

Let me make a disclaimer: I am, as many of this journal's readers are, a person who loves the beauty of mathematical computation - - just manipulating values and variables for the pure joy of it - - but if we believe that most of our students share that pure love, we are delusional. For them, we must provide reality.

Another disclaimer: I am not saying that practice is not necessary; it definitely is. A coach knows that his basketball players have to practice shooting a lot, but the coach also knows that they have to learn to shoot in a game. Skill practice does not have to be contextual, but we must never lose sight of the fact that skill practice IS NOT the game, and it is not the same as playing in the game!

Do we want students to **make sense** of the mathematics? Do we want them to **remember** the mathematics? Then we need applications. If we commit to use applications, how can we do so most efficiently and effectively? Many of you have heard how the Japanese and other countries work on one problem for a whole class period. That process may seem faulty to us and we don't understand how the idea of applying mathematics or the idea of needing to practice a mathematical skill mesh with the idea of working on one problem for an hour or so. How is it then, that we get more out of a problem?

The second part of the article: Providing examples of how to get more out of an application problem

What is the most common type of application problem? Sadly, almost all application problems are "one question problems." The situation is explained, appropriate numbers are provided, and then the question is asked. Here are two examples:

Fairly Easy Situation; Problem Too Short.

Suppose the topic is slope, and here's the problem:

The water fountain in the hall had 5 gallons of water in it, and then it started leaking. After 10 minutes, only 3 gallons of water were left in the tank. At what rate is the water leaking?

That's a really nice problem, and it's one that is actually pretty easy for students to perceive, but in the text where that problem was found, it was immediately followed by a problem about the pitch of a roof, and then another about a factory producing widgets, and so on. Especially for students who struggle, about the time they make sense of the situation around the leaking water fountain, that problem is over and they have to refocus on construction of a roof, and then on a factory, and then - - and then - - .

Teachers know what is happening - - you can see it on students' faces - - as they get lost in the situations, not necessarily in the mathematics. However, the "situation" is critical to the process. It provides the true value of the problem, which is in interpreting what the mathematics tells you about the situation. Knowing how to find slope without knowing what that number says to people in the real world is just an exercise in computation. Slope without meaning is useless. The same is true over and over - - without making meaning, much of mathematics is just an exercise in computation.

More Complicated Situation; Problem Still Too Short.

There are also times when the application is not so easy to visualize, even though the problem is a great problem. Here is an example: The speed that a car was traveling can be estimated by measuring its skid marks. The formula

$$r = 2\sqrt{5L}$$

can be used, where r is the speed in mi/h and L is the length of the skid marks in feet. Estimate the speed of a car that left skid marks of

a) 20 ft b) 70 ft c) 156.8 ft

Again, that's a great problem. The idea of how police officers can figure how fast a car was going before a crash is an idea that is of interest to students, and it is a situation students can make sense of with a little explanation, sketching, or maybe photographs. For you mathematics teacher readers, everything in that problem makes perfect sense. However, we must note that this problem (and most others) is written in formal language, and to complicate matters, the writing includes mathematical symbols. Many students, especially those who struggle, have trouble with formal language (as opposed to casual), and making sense of the situation in this problem takes some time.

However, if a teacher does take precious time to help students comprehend the situation, the payoff in understanding can be huge. The point of this article is to say that, if you take the time to do that, you should then use the problem for all it is worth!

In a workshop with secondary teachers this past winter, we worked on this idea, and I phrased it, "getting the goody out of a problem," which is the phrase my daddy used to use, as in "getting the goody out of" things like boiled peanuts (you suck on the shells) or gravy (this involves a biscuit and sopping!). Maybe those ideas came from the fact that my father lived through the Great Depression, and you tried to get the most out of everything. At any rate, the idea of getting all the good you can out of a problem makes so much sense.

OK, you may agree that making the mathematics memorable and having it make sense are important, BUT - -

1. How do you help students to understand what is happening in the problem?
2. After they understand the situation, what are some strategies and questions you can use on a regular basis to extend the problem so that it is worthwhile?

We will, later in this article, return to one of the problems mentioned above as examples of how you can mine a problem for all the ore in it. Note that through application problems, you also use all of the Process Standards: As you are problem solving, you can really get at higher-level thinking, you can differentiate (including challenge level work), you can have students provide reasoning and proof, you can promote communication, you can represent the problem and the answers in multiple ways, and of course you are providing connections to real life and to other parts of mathematics.

First, here are some steps you can use to help get more out of applications problems.

Five Steps to Help Get the Most Out of Application Problems

Step 1: Take some or all of the numbers out of the problem so that you and the students can focus on what is happening. Then help students determine what the problem is about.

You may think the idea of taking numbers out of the problem is a really crazy, and it takes some time to get good at knowing which numbers to leave out, but just try it. I have found this method is the best at getting students to write out the math in words, which can easily be converted to variables and yield an equation. Remember that a problem that has all the numbers needed to solve it is not really an algebra problem; it is an arithmetic problem, but we get frustrated with students when they tell us they don't need to write an equation; they just figured out the answer with arithmetic. Remember that we only need algebraic representation when there is truly something we don't know.

After the problem is read, ask students to

- - explain to each other (partner or other very small group) what is going on
- - draw the situation if possible
- - describe it
- - act it out
- -share with the class

We teachers sometimes say that students are not good at figuring out the word problems on high stakes tests, but they can't get better at it if we don't let them try it. Be prepared to let students struggle just a bit with the situation before you jump in, and also be prepared to let those who get it share their thinking with others.

Then, if needed, ask yourself how you can help the class visualize the problem situation? After an appropriate time, can you provide a drawing or photograph? Help them to begin a table? Help them to act out the situation?

I also like to give good problems a name – you will see later when we return to the **Leaking Water Fountain Problem** and the **Police and Skid Marks Problem**.

Spending appropriate time on this foundation step will have a huge payoff in understanding.

Step 2: Have students consider similarities to, and differences from, other problems they have studied, think about how to solve the problem, get the numbers they need, and then solve the problem.

How is this problem similar to other problems students have seen today or in the past? How is it different? Can students identify those similarities and differences? Recall that research has confirmed that identifying similarities and differences is statistically **the most effective strategy in promoting student achievement** (see *Classroom Strategies that Work* by Marzano and Pickering). In this step, you are providing connections to other areas of mathematics or other content, and you are activating prior knowledge.

Students think about how to solve the problem, share their ideas with a partner, and possibly with the class. Again, they get the benefit of the thinking of others.

Now students complete some computation.

Only when students have a sense of what is going on in the problem and have considered how to solve it are they asked to do some calculations.

The teacher then provides any numbers that were previously left out, and students complete the basic computations.

THIS NEXT STEP IS KEY!

Step 3: Students interpret the answer in terms of this problem and this situation.

Can **each student**, probably first to a partner, then perhaps in writing, explain the meaning of the answer?

Every time students work with the problem from here on, they **must interpret** orally or in writing what the answer means in terms of the problem.

Step 4: Change one or more of the numbers in the original problem.

Before computation, can students conjecture what will happen to the problem and its solutions? Will the answer be greater? Lower? Not possible? Other changes?

Work the problem with new numbers to provide several problems of additional practice. Be sure students interpret the answers orally or in writing.

Try the problem with more interesting numbers. If your students are struggling with some computational skills, you should insert fractions, decimals, algebraic expressions, expressions with exponents, or whatever other skill they need to practice, so that you are providing basic review as well as providing practice on the new concept.

Step 5: Extend the problem to a higher level, to another area of mathematics, or to another content area.

This is a big step. Add questions that take the problem a step further and/or add another layer of complexity and/or connect the problem to other areas of mathematics or other content areas. This step certainly addresses the Connections standard, and it also provides a method for differentiation, because the added questions can be on various levels.

EXAMPLE

The Leaking Water Fountain Problem

Step 1: (as originally printed) The water fountain in the hall had 5 gallons of water in it, and then it started leaking. After 10 minutes, only 3 gallons of water were left in the tank. At what rate is the water leaking? (as reframed without all the numbers for beginning student thinking; notice there is only one change, and often this process involves presenting the problem on the board or a PowerPoint rather than reading it from the textbook) The water fountain in the hall had 5 gallons of water in it, and then it started leaking. After 10 minutes, only a few gallons of water were left in the tank. At what rate is the water leaking?

- Have the problem read, ask students to
- Ask students to explain to a partner what is going on
- Ask them to sketch two water fountains, one at the beginning and one after 10 minutes
- Ask students to describe their sketches to a partner
- Ask students to start a chart (T table) using minutes and gallons and fill in what they know
- Ask students to start a graph with minutes on the horizontal axis and gallons on the vertical, and put in the starting point. Ask them to conjecture where the next point will be. Note the use of multiple representations.

Step 2: How is this problem like others we have been working on? How is it different?

- Students may notice that they have been able to start a scatterplot, like those they have created in the past, that they are creating a table of values as they might have previously done, that it looks like the amount of water is decreasing like some relationships they have seen, that they will probably end up with something like a ratio of gallons per minute, etc.

- At this point, they may notice that they don't seem to have enough information to work with, that (depending on where students are in their studies) they have not had to find a rate, that this problem did not "start off at 0 and go up" as most of the problems they have dealt with, etc.

How might we solve the problem? BIG NOTE: You may be using this problem as part of direct instruction, in which case you will be leading a demonstration of how to find the slope, all couched in terms related to the water in the tank and the minutes that have passed. Or - - at this point students may be applying a process they have already learned. You will have both types of situations. Application problems make powerful tools for teaching new concepts as well as practicing those already learned.

Provide the numbers needed, and then solve the problem. In this case, you now tell students that after 10 minutes, there were 3 gallons of water left in the tank.

- Students add to their table of values.
- Students add to their scatterplot.
- Students conjecture to partners about the rate of the leak.
- Students compute the slope, which is - 2/10 or - 1/5.

Step 3: (This step is all by itself because it is so important.) What does the slope mean in this problem?

- The water is leaking from the water fountain at the rate of 2 gallons of water every 10 minutes, or 1 gallon of water every 5 minutes.
- Ask students why the slope is negative? Why does the graph fall from left to right?
- Ask students to frame the answer in terms of "rate of change;" e.g. the rate of change of the amount of water in the fountain is a decrease of 2 gallons per 10 minutes, or 1 gallon per 5 minutes.
- It might be helpful to ask more questions about the interpretation, such as, "If 20 minutes passes, how much water will be in the tank?" If 15 minutes passes, how much water will be in the tank?" "If 30 minutes passes, how much water will be in the tank?"

Step 4: Change one or more numbers in the problem for practice.

- What if there were 12 gallons of water in the fountain at the beginning and after 10 minutes, there were 7 gallons? First ask how the answer might change, how the graph might change, how the interpretation might change? Compute and interpret the answers. Apply this same process of conjecturing to each change of numbers.
- Start with 23 gallons, and after 12 minutes, there were 17 gallons?
- Start with 16.5 gallons, and after 6 ½ minutes, there were 11.2 gallons?
- What if you don't know how much was in the tank when it started leaking, but you start catching the leaking water and recording the time. Make up a problem.

Step 5: Extend the problem to a higher level, to another area of mathematics, or to another content area.

- What would the graph look like if the tank had 20 gallons, then after the 10 minutes, it had 18 gallons, and then the water started gushing out so that after the next 10 minutes, there were only 6 gallons left in the tank? Interpret what was happening in terms of slope and rate of change.
- What would the equation look like that predicts the number of gallons remaining in the tank? (Answer: The number of gallons remaining equals -1/5 times the number of minutes plus the original 5 gallons; or $g = 1/5\ m + 5$). What would the equation look like for the problem above that began with 23 gallons in the tank? How would the equation be interpreted?
- This situation parallels others related to rate of flow of liquids: determining how much a leaking faucet actually wastes in a month, how long it will take to fill or empty a swimming pool or to draw down a reservoir. Create a problem to fit those situations or another one that you think of. Real people - - scientists, engineers, ecologists, etc. - - look at equations and their graphs to help make decisions and predictions.

Conclusions

Application problems are a key to understanding and remembering mathematics, especially for struggling students. We think we can't afford the time, but in fact we cannot afford not to spend the time. Plan to make the investment of time pay off by getting the most out of every problem. By following the steps in this article, you can do fewer problems, but do more with each one, and achieve success.

Off the Beaten Trail

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Off the Beaten Trail: Geocaching and MathCaching in the Classroom

In "Solve and Seek: MathCaching in the Classroom" (see Fall 2010 issue), geocaching and its offshoot, MathCaching, were introduced and described. Essentially, geocachers use Global Positioning System (GPS) equipment and reasoning skills to find hidden outdoor caches, while MathCachers solve math problems over a series of web pages in order to complete their hunt. This article will highlight some MathCaching teaching tips, explain how to incorporate geocaching both in and out of the classroom, and identify a number of excellent educational geocaches in Georgia.

Tips for incorporating MathCaching in the Classroom

Having assigned MathCaching activities to three different mathematics classes over the last academic year, we have developed some tips for successfully implementing MathCaching with students:

- Use MathCaching as a review activity before a unit test or final exam. MathBits.com has excellent MathCaching modules covering Basic Math, Pre-Algebra, Algebra I, Geometry, Algebra II, Trigonometry, and Pre-Calculus. Each module provides a wonderful overview of their respective subjects and would serve as a productive review at the end of a course.
- Conduct MathCaching in a computer lab. Such a setting enables students to work individually or in small groups while still allowing a teacher to provide assistance as necessary. Some MathCaching problems are difficult, so it can be frustrating for a student if he/she continually receives "Page Not Found" errors for obtaining a wrong answer. By assisting in a lab, teachers can help students pinpoint their mistakes faster to alleviate this frustration. If a computer lab is unavailable, MathCaching can also be assigned for homework as long as every student has access to an internet-connected computer at home or at a library. Due to the frustration factor, we recommend giving students at least a couple of days to complete the assignment in case they get stuck on a problem and need to ask a teacher for help.
- Assign bonus points to students for successfully completing a MathCache. Depending on the mathematical ability of students, some MathCaching modules can take hours to complete, so bonus points should be significant enough to provide motivation for students to reach the end. Be aware that answers to some MathCaching modules can be found online simply by querying an internet search engine, so be sure to insist that students show all their work in order to discourage cheating.
- Have students create their own MathCaching website. As outlined in Part I, a variety of free resources exist for students to create their own MathCaches. Students, either individually or in groups, can be tasked with creating a review for a particular concept, chapter, or unit. These caches can then be shared with every student in the class and used as a review activity.

Geocaching as an Educational Activity

MathCaching in a computer lab is an engaging way to reinforce mathematics content and skills, but sometimes, the great outdoors beckons. Fortunately, geocaching provides an opportunity to enjoy the world outside of school while still offering educational experiences. For those new to geocaching, we recommend visiting the official geocaching.com website to view an introductory video about this hobby (it can also be accessed at http://www.youtube.com/watch?v=-4VFeYZTTYs).

While MathCaching requires a computer with an internet connection, geocaching typically requires only two items:

1) GPS receiver – You can either use a dedicated receiver or a GPS-enabled smartphone. DeLorme, Garmin, and Magellan offer a variety of dedicated GPS receivers with built-in geocaching features. For younger students, an excellent GPS receiver is the Apisphere Geomate Jr. Handheld Geocaching GPS. This receiver is highly durable and has a simplified interface. Smartphones such as iPhones and Android phones can be utilized instead of dedicated receivers, but we recommend using one in tandem with Groundspeak's Geocaching app ($9.99 in the App Store or Android Market).
2) GPS coordinates for a desired cache – These can be obtained from geocaching.com or opencaching.com. Example codes (starting with the letters GC) are provided below and can be used to access more information about each cache at geocaching.com (Figure 1).

Figure 1. Geocaching.com homepage with search box for cache codes.

Many geocaches require basic mathematical skills in order to decrypt hints or successfully identify longitude and latitude coordinates. An excellent example is the Magnolia Springs State Park cache (GC26FAW), located near Millen and one of the 45 caches of the Georgia State Parks Geo-Challenge (http://www.gastateparks.org/Geocaching/Parks-Challenge). To find this cache, the following instructions are provided at its geocaching.com webpage:

> To figure out the final location of this cache, please answer the following questions. Answers are available on the Camp Lawton Kiosk, which are located at the posted coordinates.
>
> 1. What day in December did Sherman arrive in Millen?
> 2. Complete this sentence: "First was _____" (number of letters of this city name)
> 3. What was the middle name of the man who drew sketches of the camp? (number of letters of his name)
> 4. What was the mortality rate (%) for confederate prisoners?
> 5. In August of 18___ Camp Lawton came into existence. (gaparks, 2010, ¶3)

Once the answers to questions #1 - 5 are found, the numbers must be substituted into the following equations to determine the values of letters A - E:

> "A = (#4 x 2) + 1
> B = #1
> C = #2 + #3 + #5
> D = (#5 + #2) – 20
> E = #3 x 2" (gaparks, 2010, ¶4).

The letters A - E below are then replaced by their respective values to identify the final latitudinal and longitudinal coordinates of the cache:

> "Final Coordinates: N. A 52.B88 W. 0C D.59E [the N. and W. refer to north and west]" (gaparks, 2010, ¶5).

Once the final coordinates are completed, the geocacher can now use a GPS device to navigate to the location. If the coordinates were identified correctly, the GPS device should lead the geocacher near the cache's hidden site. It is important to note that consumer-grade GPS devices only provide accuracy within 10 meters (Science Education Resource Center, 2011). Tree-cover and tall buildings can also degrade accuracy, so searching a small radius may be required once a geocacher reaches the final destination. In most cases, the geocacher should successfully find the hidden cache after some careful searching. A cache is generally a small container made of plastic or metal that contains a log book of some kind, allowing geocachers to sign their name to prove that they have successfully found the cache. Travel Tags (described below) or other goodies may also be found inside of a cache and are free for the taking (please note that if you take an item from a cache, you should leave an item of equal or greater value in its place). Once the log book has been signed and any goodies have been swapped, the geocacher must now seal the cache and return it to its original hiding place so that the next geocacher can enjoy the same experience. The geocacher should also log the discovery at geocaching.com or opencaching.com for the benefit of the online community.

From an educational perspective, the Magnolia Springs State Park cache challenge addresses a variety of Georgia Performance Standards, including mathematics and social studies. For example, if this were an assignment for fifth graders, it would incorporate M5A1b, M5P1, M5P4, and SS5H1. The multi-curricular nature of geocaching is one of its biggest strengths.

Multi-caches, which require visiting multiple locations before finding the cache, are also available. One interesting and educational multi-cache is the Jekyll Island Multimillionaires' Cache (GC2B6K3) [Note: this is a "premium" cache that requires a fee to access the description online]. This cache provides a multi-step tour of Jekyll Island's rich history. In order to progress, geocachers must read historical signs posted around the island, count the letters in key words, use these numbers to discover the coordinates for the next location, and repeat the process until finally reaching the last location and the hidden cache.

Another multi-cache incorporating mathematics is Dutchy (GCR8XQ), a cache in Elberton. It spotlights a scandalous statue that once provoked a mob into action over one hundred years ago. To succeed, geocachers must find a date engraved on a statue in downtown Elberton. The digits of the date should then be added together. According to an example in the cache's instructions, "the year 1855 would result in an answer of 19 (1 + 8 + 5 + 5 = 19). The answer should be added to the last three digits of the original coordinates for West" (Music, 2005, ¶6). This resulting sum would then yield the longitude of the hidden cache's location.

In addition to mathematics, the following subjects can also be successfully explored via geocaching in the state of Georgia:

- Geography / History – The Georgia Department of Natural Resources recently launched the Georgia State Historic Sites History Trail (http://www.georgiastateparks.org/Geocaching/History-Trail), an adventure through 14 state historic sites that can be played with or without a GPS. Other caches (such as GCGMJY and GC513D) are hidden in Civil War sites. Finally, historical markers often have geocaches nearby, so we recommend doing a search of your local zip code at http://www.geocaching.com/ to discover if any history-related caches are hidden near your location.
- Literature – For those interested in literary connections, the following caches involve works by Georgia authors: Gone With the Wind (GCJQE8), The Color Purple (GC1EF8A), and The Marshes of Glynn (GCD4W).
- Oceanography – An understanding of tides is crucial to finding the Bronze Bonus Cache (GC27701) in Skidaway Island State Park.

- Geology – In order to complete the cache entitled A Product of Rock and Water (GC15VK0), Geocachers must first identify the type of rock stratification visible in the depths of Tallulah Gorge.
- Theater – The scenic town of Crawfordville in Taliaferro County has provided the backdrop for numerous Hollywood movies. The caches entitled Sweet Home Alabama (GC2GQQB), Get Low (GC2EJD), and Home Fires Burning (GC2K276) are located close to where scenes from these movies were filmed.

Since class field trips away from school grounds are generally not feasible, another way to incorporate geocaching is through the use of Travel Tags. Travel Tags are trackable items that are placed in caches by geocachers (Figure 2).

Travel Tags are intended to be found by other geocachers and moved to caches of their choosing. These items can be tracked online (http://www.geocaching.com/track/), providing detailed information about the number of miles and locations that each tag has traveled. To utilize Travel Tags in the classroom, we have released tags as part of class projects. We printed and attached information to these Travel Tags explaining our class goal of visiting as many US caches as possible (Figure 3).

Figure 2. Front and back (showing trackable code) of a Travel Tag.

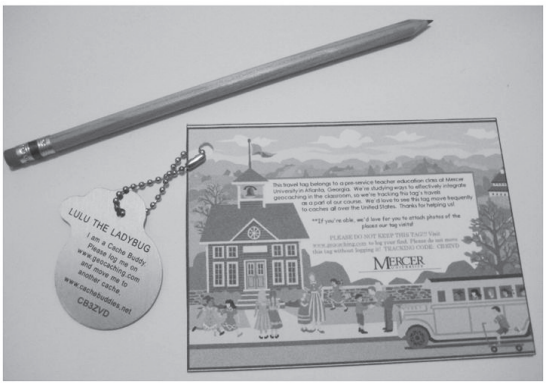

Figure 3: Example of class Travel Tag with printed information about class goal

One tag (TB3Y9CT) has already traveled more than 30,000 miles in just five months! Using information from the website, students can perform statistical calculations about a tag, such as determining the average number of miles a tag has traveled per day, or create graphs incorporating travel data.

Geocaches can be created and hidden by anyone with a free geocaching.com or opencaching.com account, and doing so could be a meaningful class activity. To get some ideas, you might investigate caches hidden in other states. For example, the Spring Animal Geometry cache (GC1FWZB), located in California, is described as follows:

> Rather than being directly at the given location, a bit of geometry is required to find this cache. The location N 37 26.598, W 122 09.327 and the given location are two corners of an equilateral triangle. The cache is at the third corner of the triangle, roughly east of the other two corners. (icknay, 2008, ¶1)

Using similar concepts, students can find an appropriate hiding place and develop an academic description for a class cache. Be sure to ask for permission before hiding a cache on school property. Once a cache is made public, a wide variety of people will likely search it out, potentially causing a disruption to the school.

In summary, MathCaching and geocaching offer new opportunities for teaching and reinforcing mathematical skills. Whether students are calculating an answer in order to access the next page of a MathCache, or they are trekking through nature and applying math to find cleverly hidden geocaches, the instructional potential of these activities is limitless. By incorporating these activities in and out of your classroom, you can provide a challenging and engaging learning opportunity that is far off the beaten trail.

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by
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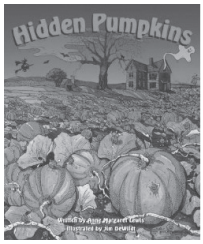
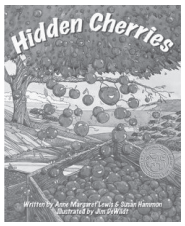
Judy's Bookshelf

Using children's literature books to promote a good math lesson is very important for many students. It will help them see how the math can be applied in real-life situations. It can help them see how a concept can be applied to life. It just makes learning fun. And that's important too!

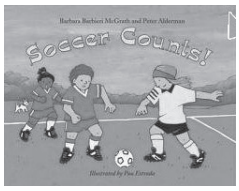
In this issue I am doing something a little different. I am focusing on counting books. All of these books will help students see what numbers look like. When they say "five", they can visualize what five things look like, whether they are zebras, cookies, toys, or shoes. They can see in their minds what five of them looks like. This is fundamental for all young children I their math building blocks. If they cannot see what a number represents, they struggle with basic number sense. So let's look at some books that can make that learning interesting and in some cases exciting.



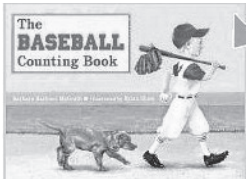
Hidden Pumpkins by Ann Margaret Lewis (2005, Mackinac Island Press) is one of those books that makes learning fun. Jim DeWildt did a wonderful job of illustrating this book. The story begins with "I'm Mr. Pumpkin from the great pumpkin patch There are 100 of me hidden for you to catch"……and the story goes from there. It's written in rhyme and oh so colorful! The students can look for Mr. Pumpkins on every page. It reminds me of those "Where's Waldo?" books and posters of a few years back. Younger ones will be excited to find the Mr. Pumpkins and older students can use column addition to see if they really find 100 of the pumpkins. This would make an exciting addition to any classroom for the fall holiday season.



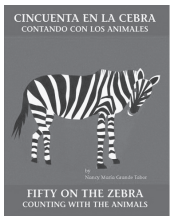
Hidden Cherries by Ann Margaret Lewis and Susan Hammon (2004, Mackinac Island Press) follows the same format as Hidden Pumpkins and again Jim DeWildt did an outstanding job of illustrating. Both of these books just beg students to explore and count. This is another must-have for your collection.



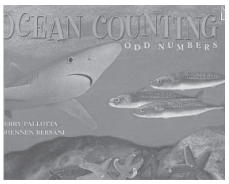
Do you have soccer fans in your classroom? Check out **Soccer Counts**! by Barbara Barbieri McGrath and Peter Alderman. (2003, Charlesbridge) They will like this book. Not only does it introduce the number, but the number words as well. It also shows how each number relates to soccer. Covering numbers from 0-15, this is a great way to learn numbers and learn more about soccer. While this is a counting book, it's also teaching students a lot about the game of soccer. In this day and time when students need more exercise, maybe this one will help encourage this.



Ms. Barbieri McGrath also has T**he Baseball Counting Book** (1999, Charlesbridge) for those that are more interested in baseball. Covering the numbers to 20, this book also provides some interesting trivia and facts about baseball. This book might be good springboards for having older students write their own book about football or basketball. Check it out and see if it fits n your class library. (It might be good to use around World Series time).



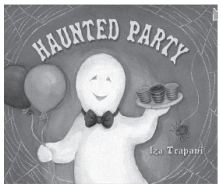
Cincuenta En La Cebra or **Fifty On The Zebra** by Nancy Maria Grande Tabor (1994, Charlesbridge) offers an unusual perspective to math literature. The book is presented in both English and Spanish on each page. The left column is in Spanish, and the right column is in English. Each page makes one statement such as "Eight bears hear the orchestra." Then that is followed by several questions that can be answered by looking at the picture. (Ex. How many penguins are playing instruments?) This book is unique in the fact that students are not only learning about numbers, but they are sharpening their observation skills. Neat idea. This would be a fun concept for children to replicate and develop their own text and questions.



The next two books are related but reach different concepts. **Ocean Counting, Odd Numbers** (2005, Charlesbridge) and Underwater Counting, Even Numbers (2001, Charlesbridge) are both written by Jerry Pallotta. If he sounds familiar that's because he has numerous alphabet books and number concept books on the market including The Crayon Counting Book, The Icky Bug Counting Book and a host more. The one thing that's consistent in all of Pallotta's books is that they are fun to read. And they are interesting to the children, and they are beautifully illustrated. OK, so that's more than one thing. These two books offer a great look at underwater inhabitants. Now, if you are using these (or any of Pallotta's books) with older students let them write word problems using the fish in the book, such as this example. How many crabs would I have if I had 23 Horseshoe crabs and 31 Hermit crabs? or If John as Moon Snails Joe has Little Green Crabs and Surf Clams, who has the most in their collection? Now the student has to read the book to find out what the counts are n the pages.

Generating topics for their own book would lead to a whole new lesson, like My Yummy Vegetable Book. For younger students, let them illustrate the book themselves. Then they could read it to a friend or take it home and read to their parents. The ideas are endless. Just remember, it all starts with a book.

Norma Cole wrote **Blast Off! A Space Counting Book** (1994, Charlesbridge) and children love to talk about space ships, rockets, outer space and being an astronaut. While the space program has advanced a lot since 1994, younger children will still love the theme and enjoy the book. Not only does it count to 20 and then back to 0 but each page teachers them a little bit about the space program. At the bottom of each page is a short paragraph that explains something about the space program that can lead to a discussion in class. This is a perfect book to reinforce counting backwards as an introduction to subtraction. Every child loves to count backward and blast off! To follow up, have children list what they would take on that spaceship….10 books to read, 9 candy bars, 8 bottles of juice, 7 ...and so on. Share these in class and then write a class book. Students could then copy that book and illustrate or create their own version.



Another cute book for the Halloween season is **Haunted Party** by Iza Trapani (2009, Charlesbridge). The book counts to 10 and then back to 0. Written in rhyme, the book is a fun read with skeletons dancing, hobgoblins eating worms, and cute vampires bobbing for apples. The illustrations are lighthearted and silly. The characters are having a good time until the trick or treaters how up and scare them all away. Here's another book great for counting forward and back, for writing their own versions, maybe writing a Halloween candy book.

Last, but no least by any means is a book entitled **Counting is for the Birds** by Frank Mazzola, Jr. (1997 Charlesbridge). This book, written about birds and numbers is all set around a bird feeder. Students get to see bird seed up close and have the seeds identified. The various types of birds are identified and little information about each species is included. The illustrations are very lifelike, almost resembling photos. Here again s another great counting book set around another theme that can easily be integrated into your curriculum. Who knows, you might launch a bird watcher into a lifelong hobby or career.

If you noticed, I've followed every book with a writing idea. There's a reason for this. First is the fact that young children love to make books and share them. Secondly, doing so reinforces the counting and number recognition. If your students take these books home to share with their parents, then the parents know what's happening at school and can reinforce the counting practice there. And here's an idea to do at home. Have students make a book or a chart showing things at home, like my house has 10 doors, 9 chairs, 8 tables, 7 rooms, etc.

If you are looking for these books, they all came from Charlesbridge Publishing. Thanks!

Dr. Rock's Math Mystery Solutions

Straight Letters Solution: TWENTY-NINE. ONE, TWO, FOUR, SIX, SEVEN, and EIGHT cannot be one of the numbers. This helps narrow the field. THIRTY, FORTY, SIXTY, SEVENTY, and EIGHTY will not work. HUNDRED, THOUSAND, MILLION, BILLION, TRILLION, etc will not work because of the O.

Sum Zeros and Ones Solution: 67,555,552. There are 6 different possible places for 0 and 1. Therefore, there will be 2^6 or 64 different possible numbers of this form. The ones place will be 1 for 32 of the possible and 0 for the other 32. This will also be the case for the tens, hundreds, thousands, ten-thousands, and hundred thousands place. Therefore when we find the sum of the 64 different numbers, the result will have 32 ones, 32 tens, 32 hundreds, 32 thousands, 32 ten-thousands, 32 hundred thousands, and 64 millions (since each of the numbers begins with a 1 in the millions place). This simplifies to 67,555,552.

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Making Mathematics FUN
Dr. Rock's Math Mystery

Elementary Brain Teaser

From Last Issue

Furry Friends

The sum the weights of a dog and a cat is 27 pounds. The dog weighs an odd number of pounds. Each animal's weight is an integer. If he weighs twice as much as she does, what are the weights of the dog and the cat?

Furry Friends Solution: The dog weighs 9 pounds and the cat 18 pounds. The problem does not state the the dog is he?? The cat is the boy and the dog is the girl. If you assume that the dog is the boy, the problem could not be done.

New One!

Straight Letters

Among those numbers whose literal representation in capital letters consist only of straight line segments (for example, FIVE), one number has a value equal to the number of segments used to write it. Determine a number that has this quality? [Note: using Arial Font, the letters that only consist of straight line segments are A E F H I K L M N T V W X Y Z and hyphens do not count as one of the needed segments]

Challenge Round

From Last Issue

Serious Sevens

How many seven digit numbers contain the digit seven at least once?

Serious Sevens Solution: 4,748,472.

A total of 9,000,000 numbers occur from 1,000,000 through 9,999,999, inclusive. Consider those that do not contain the digit 7. They can begin with one of eight digits, that is, any digit except 0 or 7 then the remaining 6 digits of the number can be any nine digits or any digit but 7. A total of 8(9^6) of these digits exist. Therefore, 9,000,000 - 8(9^6) = 4748472 numbers occur that contain the digit 7 at least once.

New One!

Sum Zeros and Ones

Think of all of the possible different seven-digit numbers of the form 1abcdef, such that the digits a, b, c, d, e, and f must either be 0 or 1. Your task is to determine the sum of all such seven-digit numbers of this form.

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