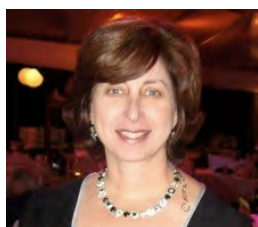


California Mathematics Council Community Colleges

# CMC<sup>3</sup> NEWSLETTER

## President's Message

Barbara Illowsky, De Anza College



To most of you, I say, "Happy summer!" To Lake Tahoe, Foothill, and De Anza colleagues, I instead say, "Happy one-month till summer!" I always find it amazing

how long the school year seems at the start of it and then how fast it flies by. Each June, I make lists of projects I will absolutely accomplish over the summer. When summer ends and they are not done (actually, most are not even started), I then give myself until the end of the school year to do the professional ones, while the personal projects

just roll over to the next summer. For CMC<sup>3</sup>, the last project on my "president's list" is for the Board to review and amend (if necessary) the CMC<sup>3</sup> By-laws and Constitution and for the membership to vote to approve such changes. Your Board has finally completed its work in bringing the by-laws into the 21<sup>st</sup> century. We did not feel that any changes to our constitution were necessary, but are suggesting substantial ones to the by-laws. This December, at our conference after-lunch session, we will hold a general meeting. During that meeting, I will ask for a motion to approve the amended by-laws. If we get a motion and a second, then we will vote. Please review the proposed changes on our web site: <http://www.cmc3.org/news.html> . If you find any typos, please email them to me and I will fix them. If you have questions and/or comments, please send those, as well.

Most of what I'll refer to here you will find in more details in separate articles in this newsletter and/or on our website: <http://www.cmc3.org> . The most important state news, aside from our dismal budget and expected cuts, is the creation of the new Associate in Mathematics for Transfer degree. Please read about this new degree in the newsletter. Once again, co-chairs Larry Green and Michael Eurgubian planned and delivered an absolutely fabulous spring conference. The highlight for me

(see **President's Message** continued on p. 3)

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## CMC<sup>3</sup> Now officially Provides Endorsements for Statewide Math Efforts

*by Larry Green, Lake Tahoe Community College*

Are you are a CMC<sup>3</sup> member writing a proposal for a multi-district effort that focuses on the teaching and learning of mathematics at the California Community Colleges? CMC<sup>3</sup> now may provide a formal endorsement for such efforts. This can be helpful when applying for grant funding or when seeking out a mathematics policy change at the state-wide level. Awards committees are often looking for proposals that have the official endorsements from their state-wide organizations. CMC<sup>3</sup> is dedicated to assisting community college math faculty and their activities that encourage the teaching and learning of mathematics and this is one more way that the organization serve its members. The new CMC<sup>3</sup> endorsement policy can be found on the CMC<sup>3</sup> webpage at:

<http://www.cmc3.org/resource/EndorsementPolicy.html>. You can send your requests for endorsements to Larry Green, Barbara Illowsky, or Susanna Crawford.

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## President's Message

(continued from front page)

was our first student keynote speaker, Andrew Gabriel from Santa Rosa Junior College. Read the Tahoe article to learn why Andrew made his presentation. While you are on summer break, this year's Monterey Conference Chair, Susanna Crawford, is busy putting together the speaker schedule with help from Wade Ellis. Be sure to read Susanna's article, along with Rebecca Fouquette's article about the student poster session for the Monterey Conference. Finally, this fall we will hold our biannual elections. I encourage each of you to get more involved with CMC<sup>3</sup> and/or the CMC<sup>3</sup> Foundation. If you are not sure how to become more involved or what you might want to do, consider coming to our September Board meeting in Davis. (Email me for complete information.) Or, run for an at-large position which offers lots of flexibility.

I wish you all a great summer! I will be available via email most of the summer and would love to hear from you!

## What's Happening at City College of San Francisco?

*Katia Fuchs*

In the Spring of 2011, ten City College mathematics instructors began meeting with a group of San Francisco high school math teachers with the goal of improving the transition from high school to community college for San Francisco Unified School District graduates who attend CCSF. In particular, the group is hoping to close the achievement gap for African American and Hispanic students. These efforts are part of a three-year "Bridge to Success" grant funded by the Gates Foundation.

(see CCSF on p. 14)

## The Monterey Poster Session is Back and Better Than Ever!

*Rebecca Fouquette, Santa Rosa Junior College*

It's back!! The annual CMC<sup>3</sup> Monterey poster session will be occurring during the Saturday sessions this year at our Monterey conference. This poster session offers community college students a chance to participate in our conference through the creation of a poster to display. Posters can involve any level of mathematics that extends the usual curricula (no book problems!). Independent study projects or modeling problems are encouraged. New this year, we are offering a prize of \$75 for the best poster and \$25 for the runner up. There is no fee to enter and the student gets free registration.

For a student to submit a poster, he or she should be a current community college student for Fall 2011 and a current CMC<sup>3</sup> faculty member must sponsor the student. Students will be asked to provide an easel to display their work. Faculty sponsors are asked to ensure their sponsored student is able to attend the conference, that the student has all the materials he or she needs and supervise the set up and clean up of the poster.

Posters will be displayed during the Saturday conference. Students are asked to be available to answer questions on their poster during an assigned time. Any interested students should complete an abstract and submission form available in September on our website, [www.cmc3.org](http://www.cmc3.org). Submissions will be accepted between September 1, 2010 and November 25, 2010. For more information contact Rebecca Fouquette at [rfouquette@santarosa.edu](mailto:rfouquette@santarosa.edu).

## THE FIFTEENTH ANNUAL RECREATIONAL MATHEMATICS CONFERENCE

*By Michael Eurgubian, Santa Rosa Junior  
College, Petaluma Campus*

On April 29th-April 30, 2011, CMC<sup>3</sup> hosted its Fifteenth Annual Recreational Mathematics Conference at the MontBleu Hotel and Casino in Stateline, Nevada. This conference, whose focus is on mathematical topics, rather than primarily pedagogical ones was held for only its second time at this venue, which has proven to be a delightful one for many, across the highway from our previous site, the Horizon Hotel and Casino.

The conference began Friday April 29 with its usual keynote presentation, this year featuring Jean Bee Chan, of Sonoma State University, whose talk was entitled "*A View of an Art Gallery*". Dr. Chan's chat was a rare look into the field of computational Geometry.

The next morning, the conference resumed with its four usual sessions of three breakout speakers each, and in between, a lunch break and Saturday keynote presentation from Stuart Moskowitz of Humboldt State University. His presentation was entitled "*Making Puzzles Less Puzzling with Math*". Attendees were treated to the results of his extensive research into the history of puzzles and the product of recent visit with Jerry Slocum, who created the country's first "Puzzle Museum".

After a full day of recreational mathematics, the attendees were treated to our second-ever student scholarship

speaker, Andrew Gabriel, a student at Santa Rosa Junior College, whose presentation explored Georg Cantor's transfinite set theory, his fierce opposition, and his spiral into mathematical insanity. After his talk, she was presented a \$500 scholarship, funded entirely through the generosity of Debra Landre of San Joaquin Delta College, and a past President of CMC<sup>3</sup>.

Topping the conference off was our usual reception loaded with fellowship and prizes. This year the conference also served to generate hundreds of dollars for the CMC<sup>3</sup> Foundation. This years conference participants exceeded 100 including a record number of students. 11 other recreational talks, every one very well received, covered a host of topics and perpetuated our history of delivering a truly unique conference. The weather was also beautiful!

As usual we are officially recruiting speakers for the sixteenth conference to be held April 27 - April 28, 2012. We are looking for recreational topics especially from new and adjunct instructors. For more information, contact me at [meurgubian@santarosa.edu](mailto:meurgubian@santarosa.edu). In addition, if you are interested in gathering materials presented at this conference by speakers, visit our Website.

We hope you will make plans to attend and/or present at this unique conference in 2012!



## What's Happening at Mission College

*Karl Ting*

The Mission College Math department strives to create a caring and learning environment for our thirteen Full-time and about twenty Associate faculty so that we are able to exchange ideas and take on projects aimed at helping our student populations to succeed in mastering various levels of mathematics.

One of the things that distinguish our department is our close relationship with associate faculty. Before every semester begins, the math department gathers all Full-time and Associate faculty for pizza at our Math Learning Center so that we can get to know each other better. We also take that opportunity to talk about teaching issues such as exchanging ideas on pedagogy and tips on dealing with difficult or unmotivated students. Once we invited a guest speaker to talk about teaching basic skills



students. After the semester starts, things get hectic and so this gathering is an invaluable time, and especially for our associate faculty who sometimes feel isolated.

In addition to that gathering, the department has developed a practice of having

two to three colloquia per semester to which all math faculty are invited. Topics range from latest technology for teaching, best teaching practices, interesting math history and best ways to help basic skills students to develop proper math study skills. Both Full-time and Associate faculty participate in these discussions.

On going professional activities for a large majority of our full time faculty members include the annual CMC3 Conference, departmental retreats, the AMATYC contest, conferences, and articulation with our feeder schools.

In terms of teaching, one focus of the department is on adopting technology in classes. For example, three of our faculty have been using Tablet PCs to enhance their teaching delivery. One member provides students with handouts in advance so that he can project the handout onto the screen in class and writes notes on his Tablet during lecture. Another member delivers his lecture entirely on his Tablet with the projection on the screen in class and then posts his pdf-notes on his website for students to download after class. In that way, students can focus on his lecture without having to both listen and copy notes at the same time. The third member uses the Tablet to work out math problems during her web-office hours for her online classes.

Another focus of the department has been on helping the very weak but motivated students to succeed in learning math in our Elementary-Intermediate Algebra course sequence. An ongoing project is the MAPS (**M**ath **A**chievement **P**athway to **S**uccess) program, which is now in its fifth year. It was initially part of our Title V Grant pilot project to develop a learning community with extended class instruction, counseling assistance and dedicated math tutoring for a self-selected group of motivated students. The success rate has been around 75% as compared to about 50% with the traditional sections. A number of those students continue to enroll in transfer level courses and graduate with an AA degree or

transfer. Since the end of Title V Grant, we have had difficulty obtaining full funding. However, in view of the value of this program for our students, we have continued it without the counseling component and still have maintained a significantly better success rate than in our traditional sections.

To address the need of our most basic Arithmetic course students, three of our faculty have been piloting the “Singapore Math” approach which emphasizes problem solving skills development. The topics are still whole numbers, fractions, decimals and percents, but they are introduced in a spiral fashion so that topics are covered from simple to more complex in several cycles. In this way, students are reminded of these topics again and again throughout the semester. Moreover, the word problems are more challenging than comparable ones in a traditional textbook, although they are presented in simple sentences. This is especially beneficial for our English as Second Language student population. A fourth pilot instructor, who is trying the "Singapore" approach for the first time this semester, comments that he sees an attitude change when the students accept the challenge and are willing to take a different mindset to how they have learned in the past. He feels that they will eventually benefit. Our success rate for this approach in the last 2½ years has been around 70% as compared to 35% in traditional sections. Our challenge is to prepare them to succeed in the next level math course.

Our newest pilot project is this summer’s Summer Bridge for High School Students. This is a learning community project in partnership with a reading instructor and a counselor to provide a summer bridge program for graduating high school seniors who are not quite ready for college.

In terms of student support, our department provides a tutoring center devoted to mathematics and oversees the hiring of tutors.

We provide training sessions several times a semester to insure continuity and to address concerns brought to our attention during the semester. Several courses such as Singapore



Math, Math for Liberal Arts, and statistics that require the use of a variety of teaching styles and methods provide a challenge for student tutors who are proficient in math, but are not as flexible to teaching math beyond the traditional approach. The training sessions address those special areas as well as best approaches to addressing student/tutor interactions covering a variety of scenarios. This is in addition to a tutor training class that tutors must take.

As experienced by many of our colleagues at other colleges, demands for a self-sustaining economical model for tutoring is ever present. In writing this article, we hope to not only give our colleagues a glimpse of what is happening at Mission, but to open a dialog to share successful implementation of models in any of the areas we have shared with you in this article. We are a community, and it has never been more important to share ideas than in this time of economical uncertainty.

In closing, apart from all the projects that our faculty are involving in, we would like to acknowledge the contribution of one of our very

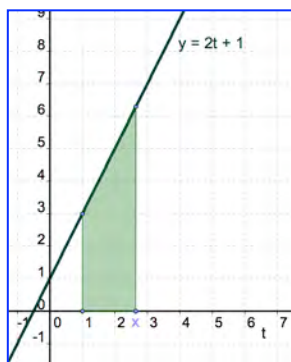
**(see Mission College on p. 12)**

## Handouts, and Sharing

Ken Bull, College of San Mateo

The main goal of these “posts” is to raise questions. Unusually, *this* post argues a case, although perhaps it may raise some questions as well. Here, I argue the case for creating, using and sharing “handouts” (or “worksheets” or “partner exercises”) in our teaching. Perhaps the case need not be made, and the readers of this newsletter are already avid users of handouts, but just in case, here is what I mean, followed by the argument.

I am primarily thinking about handouts that are in-class exercises, but they may also be examples, or extra information, or out-of-class exercises. As an example, let me offer a description of a handout that I used when teaching from one of the Stewart calculus texts. In these texts there is a “discovery project” that comes just before the section of the Fundamental Theorem of Calculus. This exercise introduces students to area functions of the sort  $A(x) = \int_a^x f(t) dt$  where  $f(x)$  is chosen (initially) so that the integral is positive. The idea of the discovery project is partly to introduce students to a kind of function that they have not seen before (an integral with a variable as the upper limit) and also to motivate the *FTC*. The project has the students find the area between  $y = 2x + 1$  and the  $x$  axis (by geometry), then integrate the function to find the area, and then differentiate to see that  $A'(x) = 2x + 1$ . The project continues using the sine function for  $0 \leq x \leq \pi$ . Of course, it would be simple enough to simply assign the project from the text,



either as a class exercise or as homework. However, I wanted something just slightly different from what was in the text: I wanted something with the graphics partly there (but with the students doing some shading, and showing the  $x$  on the  $t$  axis). I wanted something with a few extra small steps added but some of the parts of the original project deleted as well. So I turned the project into an In-Class Exercise handout (an “ICE”, if you will). It was not difficult, and was fun.

Most readers of this newsletter are likely to agree that using handouts that encourage active in-class work by students is a Good Thing; yet I know many instructors who make very little use of handouts of this sort. Here are some of the advantages of using handouts.

First, the kinds of handouts that I envision have the potential to engage students with the material being studied; the handouts can draw attention to problematic points or to get students to take an extra step that would not be taken if the goal (from the student’s point of view) is simply to find the numerical answer. For example: for algebra, relating solutions to the domain of a function (checking for “extraneous” solutions) or relating solutions graphically can be encouraged with handouts that specifically ask that these steps be taken. Graphing can be tedious if a grid is not provided, and there may be times that one wants to provide the function itself.

Secondly, there is a sense of immediacy to handouts -- immediacy that has several dimensions. Students do not usually know the content of handouts ahead of time, so there must be a certain element of surprise which contrasts with the usual “questions, demonstration/lecture, practice” routine that can become . . . well, routine. There is immediacy in another sense as well. Instructors can use handouts to address what they perceive are specific weaknesses or (perhaps less likely) to capitalize on unexpected strengths in a particular semester. If the class-work is counted as part of the course assessment, some reward is given to those who are consistent about coming to class and some punishment to those who are habitually absent.

Thirdly, there is great flexibility in the way in which handouts can be used. My example above can be used in a collaborative

fashion -- or not. Generally, unlike quizzes or tests, help from other students or the instructor is encouraged rather than forbidden, so they need not be simply thinly disguised quizzes.

Fourthly: making handouts *is* possible by most of us. Nearly all of us have word processors with equation editing facilities, or use *LATEX* and nearly all of us can have a means of making graphics using something like *GeoGebra* (the graphic shown here), *Geometer's Sketchpad*, *Maple*, *Autograph* or *Excel*. And once they are made, handouts can be saved on our computer. Very likely the next time that we use a handout we will find that it needs to be modified; we find that a question did not really work, was ambiguous, or will not really be appropriate for the class that we are teaching now. Or having used the handout one time, we think of ways that it can be expanded or condensed or otherwise improved.

Fifthly, and looking into the future and technology: One of the advantages that mathematics on-line courses possess is that students have the potential to do numerical work or graphing using software (even something as simple as *Excel*). Also, there are applications that have a dynamic quality; students can see how a sum of the areas of rectangles converges to a limit. There may be texts that are set up so that students have a way of interacting with the software, and then showing that they have indeed interacted with it, but I suspect that most of this kind of work will need to be done by instructors first.

Finally, handouts can and should be shared with other instructors. At times, we are terribly individualistic, and very likely the way someone else has made a handout will not suit us, even down to the appearance of the document (font, etc.) If the department has something like a share point, or a central depository for teaching materials (either paper or electronic) then sharing should be easy. Such sharing would be a kind of localized version of the Open Textbook movement, with creative commons happening locally, where the people involved may be able to meet each other face-to-face, and discuss what they like and do not like about what they have

created. There are some practical considerations for such sharing to work, of course. When people use applications that not everyone has or uses (such as *Geometer's Sketchpad* or *LATEX*) sharing will be difficult. These practical considerations can be overcome where the will to share is there, but these practical considerations could be a significant barrier where the tradition of collaboration is lacking.

#### Drawbacks to creating handouts?

"Too much work! I do not have the time to make my own materials," I can imagine someone saying; "it appears that you want us to write our own textbooks; isn't that why we have texts, so that we do not have to do all of that work, and so that it is done by someone more competent than I am." A second objection is that there may be potential handout "authors" who are actually not good at making these things, and may produce rubbish, or at best, things that have some good ideas, but are ugly.

There is some merit in both these objections. Someone who teaches (part-time) 21 units at three colleges is unlikely to have much time for anything productive or creative – or interesting; that this is so is just yet another symptom of the injustice and folly of the part-timer system. And it is true that not all of us are good at producing materials. My answers to these objections are not complete, and one of them, I fear, may not work.

First, there is a learning curve to producing handouts, but it tends to be not that steep, and tends to be enjoyable. A good place to start is to "morph" the project or "group exercises" that one finds in many texts into something that can be done in class. That is one reason I began this with the example that I did.

The second answer is: share and borrow! In this answer I have considerably less confidence. Generally, our academic culture, perhaps our own pride as teachers, is against borrowing what someone else has done, and we often find that we need to put a good deal of work into what someone else has done. And perhaps it is our pride



that also makes us reluctant to share. However, both at the college level and beyond, sharing is good. I would say, sharing is especially good at the college level, where one is able to meet the producer of something face-to-face. In this connection, I should add that there is a regional level organization for sharing; they are the Bay Area Knowledge Exchange: see <http://bayareadevmath.groups.curriki.org>.

As Tom and Ray Magliozzi would say to someone fixing an old car: "Good luck!"

## Interested in Becoming a CMC<sup>3</sup> Leader?

by Larry Green, Lake Tahoe Community College

CMC<sup>3</sup> elections are soon approaching. The organization is always looking for enthusiastic members to step up and help with the activities that CMC<sup>3</sup> does. There are several elected positions that the membership will vote on this fall. The positions up for election are:

- President Elect: Responsible for chairing the Fall Conference in Monterey and assisting the president as needed. The president elect automatically becomes president after two years and past president after four years.
- Secretary: Responsible for taking minutes at all meetings and maintaining CMC<sup>3</sup> documents and records.
- Treasurer: Responsible for all financial records, filing tax forms, preparing and presenting the annual budget, and serving on the Foundation Board

## Mark the Date!

**Monterey Conference  
December 10 and 11  
Monterey Portola Hotel  
and Spa**

**See fantastic presentations  
Meet other dedicated  
Instructors  
Enjoy the beautiful Monterey  
Bay scenery**

- Members at Large: There are four members at large who serve on the CMC<sup>3</sup> board. They are assigned tasks by the president such as: Awards Chair, Audio-Visual Chair, Articulation Breakfast Chair, and Campus Representatives Chair.

Any member of CMC<sup>3</sup> who is a present or past faculty member at a California Community College may run for office. If any position interests you or if you want to help with other CMC<sup>3</sup> activities, please contact Larry Green, Past President, at [DrLarryGreen@gmail.com](mailto:DrLarryGreen@gmail.com) or (530) 541-4660 x 341. The CMC<sup>3</sup> board works well together to put on its annual conferences and serve as a voice for math faculty at California Community Colleges. I encourage all interested members to run for office and become a CMC<sup>3</sup> leader.

## CMC<sup>3</sup> Foundation

*Cynthia Speed, CMC<sup>3</sup> Foundation President*

The CMC<sup>3</sup> Foundation is in the process of awarding nineteen \$400 CMC<sup>3</sup> Foundation Scholarships. Since not all colleges have forwarded the name of their student winner, this is an in-progress report. The Foundation will also be awarding five AMATYC Scholarships to the top five students in the Student Math League Competition. The First Place Winner receives \$500, Second Place \$400, Third Place \$300, Fourth Place \$200 and Fifth Place \$175.

The CMC<sup>3</sup> Foundation Scholarship winners and their colleges are

Allan Hancock College	Luke Phillip Larson
Berkeley City College	Esther Rojas-Soto
Cabrillo College	John Poliquin
Canada College	Francisco Lopez
College of Alameda	
College of Marin	Luis Tercero-Lopez
College of San Mateo	Jessica Yoshiko Kurata
Columbia College	Meghan McKinney
Folsom Lake College	Sam D'Anna
Foothill College	
Lake Tahoe Community College	Jared Arnold
Lassen College	Walter Kagel
Merritt College	
Porterville College	Jennifer K. Davis
Santa Barbara City College	Allison Van Pelt
Solano Community College	Bardia Keyoumars
Taft College	Dalton Thornsberry
West Hills College	
Yuba College	Jaime Munoz

The AMATYC Student Mathematics League Competition winners and their colleges are

First Place	Mission College Dang Minh
Second Place	West Valley College Kevin Mu
Third Place	West Valley College David Wang
Fourth Place	Diablo Valley College Chan Pong Lei
Fifth Place	Ohlone College Xin Ma

The recipients of a CMC<sup>3</sup> Foundation Scholarship must meet the following criteria:

- a. Completed first semester Calculus or higher,
- b. Declared Mathematics, Physical Science, Computer Science, or Engineering as a major,
- c. Earned more than 30 semester or 45 quarter units and plans to transfer to an accredited college or university for the next academic year, and
- d. Earned a GPA of 3.0 or higher.

The funding for our scholarships comes primarily from our member's donations, door prize proceeds, professional organizations, and business contributions. We are preparing for our Fall Mathematics Conference in Monterey and are seeking donated items for our Scholarship fundraising activities. Please contact any of the Foundation Board members if you have any prizes, puzzles, books, or any other miscellaneous items that you wish to donate for our drawing. We are hoping that the textbook publishers will help out by contributing very sought after and desirable

items. The Foundation Board members for 2011 are Rebecca Fouquette of Santa Rosa Junior College, Larry Green of Lake Tahoe Community College, Wei-Jen Harrison of American River College, Debbie Van Sickle of Sacramento City College, and Cynthia Speed from Mendocino College.

We are deeply grateful to all of our Donors and they will be acknowledged in the 2011 Monterey Conference Program. This fiscal year, a partial list of donors from July 1<sup>st</sup>, 2010 through January 2011 are Anonymous, Charles Barker, Steve Blasberg, Guy De Primo, James Eckerman, Noelle Eckley, Michael Eurgubian, Rebecca Fouquette, Patty George, Richard Hansen, Barbara Illowsky, Marcella Laddon, Gary Ling, A. Podkolzin, Tracy Rabinowitz, Cynthia Speed, Cynthia Stubblebine, Janet Tarjan, Frederick A. Teti, Allyn Washington, and Raymond Wuco. Please consider joining this list of Donors by completing the attached Donation Form and mailing your donation to Rebecca Fouquette at Santa Rosa Junior College. If you would like to be listed in the Monterey Program this December, you have until June 30<sup>th</sup>, 2011 to make a cash donation or contribution to the CMC<sup>3</sup> Foundation. In order to continue awarding scholarships, we find it necessary to increase the amount of cash donor contributions. So we are hoping that our members will be generous for this great cause.

The CMC<sup>3</sup> Foundation is extremely grateful for all of the prizes that were donated at our Lake Tahoe Recreational Math Conference. We wish to acknowledge and thank Cengage for a \$100 American Express Card, Pearson for one \$185 iPod Touch, Pearson for a \$25 iTunes Gift

Card, MontBleu for an extended stay at their Resort Casino & Spa.

Former CMC<sup>3</sup> President, Debra Landre, donated \$500 last year, to support the Student Speaker Scholarship at the CMC<sup>3</sup> Spring Recreational Mathematics Conference in Lake Tahoe. This year, Andrew Gabriel spoke on “To Infinity and Beyond” and received a standing ovation. Next year during the Spring 2012 Recreational Math Conference there is an opportunity for one of your students to compete for this great scholarship. Applications, instructions, and selection procedures are available on our CMC<sup>3</sup> website, <http://www.cmc3.org>. The link to the submission form is at <http://www.cmc3.org/conference/callForStudentProposal.html>. Please help us recruit applicants by announcing this wonderful opportunity to the students and faculty at your college. The Student Speaker Scholarship winner receives a \$500 check and a marble plaque.

The Foundation relies heavily on your generous donations to fund scholarships. Please consider making a donation to the CMC<sup>3</sup> Foundation Scholarship Fund so that we can continue to honor our most gifted, talented, and deserving students. Whether your donation is \$5, \$10, \$25, \$100, \$500 or more, we thank you for your continued support. Contributions are tax deductible, as provided by law, and our Taxpayer ID number is 94-3227552. Please complete the attached donation form and mail your donation to

Professor Rebecca Fouquette  
Santa Rosa Junior College  
Mathematics Department  
1501 Mendocino Avenue  
Santa Rosa, California 95401





# Through the History Glass

J. B. Thoo, Yuba College, jthoo@yccd.edu



This is the last of three installments of this column in which we take a look at a few of the “number theoretic” propositions in Euclid’s *Elements*.

In Book VII of the *Elements* [?] is the algorithm that now bears Euclid’s name for finding the highest common factor or greatest common divisor (the “greatest common measure”) of two numbers without having to find all the factors of the numbers or having to prime factorize the numbers. The algorithm relies on division, done as repeated subtraction in the *Elements*. Euclid gives his algorithm in two parts: Proposition 1 applies to numbers that are relatively prime (“prime to one another”), and Proposition 2 applies to numbers that are not. Today, Euclid’s algorithm may be stated like this.

**EUCLID’S ALGORITHM**

Let  $a$  and  $b$  be natural numbers, and suppose that  $a > b$ . Perform the following sequence of divisions:

$$\begin{aligned} a \div b &= q_1 \text{ R } r_1, \\ b \div r_1 &= q_2 \text{ R } r_2, \\ r_1 \div r_2 &= q_3 \text{ R } r_3, \\ &\vdots \\ r_{k-2} \div r_{k-1} &= q_k \text{ R } r_k \end{aligned}$$

until the last remainder  $r_k = 1$  or  $0$ .

If  $r_k = 1$ , then the  $\text{hcf}(a, b) = 1$ , so that  $a$  and  $b$  are relatively prime. If  $r_k = 0$ , then the  $\text{hcf}(a, b) = r_{k-1}$ , the last divisor.

For example, to find the  $\text{hcf}(29,309, 37,647)$ , we divide

$$\begin{aligned} 37,647 \div 29,309 &= 1 \text{ R } 8338, \\ 29,309 \div 8338 &= 3 \text{ R } 4295, & 8338 \div 4295 &= 1 \text{ R } 4043, \\ 4295 \div 4043 &= 1 \text{ R } 252, & 4043 \div 252 &= 16 \text{ R } 11, \\ 252 \div 11 &= 22 \text{ R } 10, & 11 \div 10 &= 1 \text{ R } 1. \end{aligned}$$

Therefore, the  $\text{hcf}(29,309, 37,647) = 1$ , so that 29,309 and 37,647 are relatively prime. As another example, to find the  $\text{hcf}(60, 27)$ , we divide

$$60 \div 27 = 2 \text{ R } 6, \quad 27 \div 6 = 4 \text{ R } 3, \quad 6 \div 3 = 2 \text{ R } 0.$$

Therefore, the  $\text{hcf}(60, 27) = 3$ , the last divisor.

Now here is Euclid’s algorithm stated in the *Elements*.

**Proposition 1** *Two unequal numbers being set out, and the less being continually subtracted in turn from the greater, if the number which is left never measures the one before it until an unit is left, the original numbers will be prime to one another.*

Since repeated subtraction equates to division, we see that Proposition 1 describes exactly what was carried out in the example above to show that the  $\text{hcf}(29,309, 37,647) = 1$ .

In the following, recall that numbers were represented by lines, planes, and so on. Thus,  $AB$  (which acts like a variable, say  $x$ ) is the number represented by the segment with endpoints  $A$  and  $B$ , and so on; and, near the end,  $G$  is the number—assumed to be a common factor of  $AB$  and  $CD$ —represented by a line segment without identified endpoints.

**Proposition 2** *Given two numbers not prime to one another, to find their greatest common measure.*

Let  $AB, CD$  be the two given numbers not prime to one another.

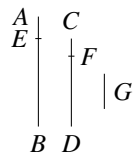
Thus it is required to find the greatest common measure of  $AB, CD$ .

If now  $CD$  measures  $AB$ —and it also measures itself— $CD$  is a common measure of  $CD, AB$ .

And it is manifest that it is also the greatest; for no greater number than  $CD$  will measure  $CD$ .

But, if  $CD$  does not measure  $AB$ , then, the less of the numbers  $AB, CD$  being continually subtracted from the greater, some number will be left which will measure the one before it.

For an unit will not be left; otherwise  $AB, CD$  will be prime to one another, [VII. 1] which is contrary to the hypothesis.



Therefore some number will be left which will measure the one before it.

Now let  $CD$ , measuring  $BE$ , leave  $EA$  less than itself, let  $EA$ , measuring  $DF$ , leave  $FC$  less than itself, and let  $CF$  measure  $AE$ .

Since, then,  $CF$  measures  $AE$ , and  $AE$  measures  $DF$ , therefore  $CF$  will also measure  $DF$ .

But it also measures itself; therefore it will also measure the whole  $CD$ .

But  $CD$  measures  $BE$ ;  
therefore  $CF$  also measures  $BE$ .

But it also measures  $EA$ ;  
therefore it will also measure the whole  $BA$ .

But it also measures  $CD$ ;  
therefore  $CF$  measures  $AB, CD$ .

Therefore  $CF$  is a common measure of  $AB, CD$ .

I say next that it is also the greatest.

For, if  $CF$  is not the greatest common measure of  $AB, CD$ , some number which is greater than  $CF$  will measure the numbers  $AB, CD$ .

Let such a number measure them, and let it be  $G$ .

Now, since  $G$  measures  $CD$ , while  $CD$  measures  $BE$ ,  
 $G$  also measures  $BE$ .

But it also measures the whole  $BA$ ;  
therefore it will also measure the remainder  $AE$ .

But  $AE$  measures  $DF$ ;  
therefore  $G$  will also measure  $DF$ .

But it also measures the whole  $DC$ ;  
therefore it will also measure the remainder  $CF$ , that is, the greater will measure the less: which is impossible.

Therefore no number which is greater than  $CF$  will measure the numbers  $AB, CD$ ;  
therefore  $CF$  is the greatest common measure of  $AB, CD$ .

Q.E.D.

**PORISM.** From this it is manifest that, if a number measure two numbers, it will also measure their greatest common measure.

We leave it to you, gentle reader, to show that this is, indeed, what we now call *Euclid's algorithm*.

Previous columns are on the Web at <http://ms.yccd.edu/~jb2/histglass.html>.

## References

- [1] Ronald Calinger, *A Contextual History of Mathematics*, Prentice Hall, Upper Saddle River (1999).
- [2] Euclid, *Euclid's Elements* (all thirteen books in one complete volume), the Thomas L. Heath translation, editor Dana Densmore, Green Lion Press, Santa Fe (2003).
- [3] Sir Thomas Heath, *A History of Greek Mathematics, Volume 1, From Thales to Euclid*, Dover Publications, Inc., New York (1981).

## Breakfast, Anyone?

Steve Blasberg, *West Valley College*

You may not be aware that the California Math Council of Community Colleges provides financial support for articulation activities sponsored by community colleges in Northern California. In the past, these activities have included such events as Saturday breakfasts, afternoon meetings, and weekday dinners. A typical event might involve inviting high school math teachers from the surrounding area to your campus on a Saturday morning for breakfast to discuss such issues as math prerequisites at the community college, course equivalencies between high school and college, the handling of Advanced Placement courses, and any other issues of interest to both high school and community college math instructors.

Up to \$300 of financial support can be provided by CMC<sup>3</sup> for hosting an articulation event. If you would like to host such an event and are interested in support for it, contact the Board Member in charge of articulation, Steve Blasberg, by mail at West Valley College, Saratoga, CA 95070, by phone at (408) 741-2564, or by email at [steve.blasberg@wvm.edu](mailto:steve.blasberg@wvm.edu). Funds are distributed on a first-come, first-served basis, subject to consideration of geographical diversity.

### CCSF (from p. 3)

City College Mathematics has developed its own Student Equity Plan and is piloting an accelerated option for Elementary and Intermediate Algebra. Students can take an intensive 8-week Elementary Algebra class followed by an 8-week Intermediate Algebra class in the same semester. So far, the results look promising.

Another big project is Stats Pathway, a one semester alternative to the Elementary and Intermediate Algebra sequence as a prerequisite for statistics. A curriculum for such a course has been proposed and reviewed, and it will be piloted in the Fall semester of 2011.



## Math Nerd Musings

Jay Lehmann, College of San Mateo

Why do you teach? Is it because you can make a difference in students' lives? Is it because you can talk about ideas while students hang on your every word? Or maybe you love being

in an environment where you and others tinker with mathematics. Do you like that you're essentially your own boss? Or maybe it comes down to having a whopping fourteen weeks off every year. Or all of the above.

My reasons have bounced around over the past twenty years of teaching. I do greatly value making a difference in students' lives, but I've often wondered to what degree I'm helping. Sometimes it seems like my classes are neatly divided into three groups:

- those that already know the material and could pass the class even if a donkey stood at the front of the room braying at them all semester long,
- those who have such huge gaps in their understanding of mathematics that I can't possibly help them, and
- those who have the ability to succeed but will have to work hard, and they have no interest in putting in that kind of effort.

It's the last of these groups that drive me crazy. It's as if they're drowning at sea, and I'm tossing them life preservers, but they won't reach out a mere inch to grab hold, and I have to watch them slowly sink below the surface.

So whenever a student takes the initiative to attend my office hours, it grabs my attention,

especially if they've never done so before, and even more so if the student is in a low-level course such as elementary algebra. One such elementary-algebra student (I'll call her Lucy) approached me in the middle of a recent semester. She said, "I think if I can just learn the rules, I can do this."

Well, on the one hand, this could be an insightful comment if the student were thinking along the lines of the axioms of math. On the other hand, this could be another version of, "Help me memorize where I should move stuff so I get the right answer."

I hoped for the former but got the latter; however, I don't think it was for lack of trying on Lucy's part. Conceptual thinking just didn't click for her. And I don't mean high-level stuff. Take the equation  $x + 3 = 7$ . Lucy would want to "move" the  $x$  to the right, rather than the more efficient tactic of "moving" the 3 to the right. We'd discuss why moving the 3 would be more efficient, but these sorts of strategic concepts would escape her. But weirdly, she *did* understand that we needed to perform inverse operations to move the  $x$ , and the 3. And she *would* remember to perform these operations on both sides of the equation.

I have to admit, I was pretty thrown by all of this. And given Lucy's slow progress even while working with me, I doubted she was going to pass the course. After all, we were starting at quite a low point: her test performance had sunk from a C on the first test to a low F by the third test, just before she first stepped into my office.

But there were two things that gave me hope. First, she wrote really fast. I know, this sounds so superficial. But most students that have great difficulty in lower level courses write S-L-O-W-L-Y. And often their penmanship is poor, as if they never pushed a pencil before. But Lucy wrote fast and with

confidence, even if most of her work was dead wrong. My gut told me Lucy had high intelligence that was getting hindered by some other factor, such as a learning disability, a psychological trauma, or poor instruction in past courses.

And the other thing that gave me hope? Lucy developed her own strategies. For example, to remember to introduce an operation on both sides of an equation, Lucy would circle the operation on both sides. Totally her idea, which was quite effective. Another example? When I would tell Lucy a rule, she would write it out. I got the impression it didn't matter where. She could've written it on a scrap of paper and tossed it out the window. Her recall on the particular skill would stick really well. It was as if the process of writing the rule carved it into her brain.

At first our meetings were infrequent. Just a couple of times a week. We were making progress, but my lectures were pulling ahead of us. She was still struggling with solving linear equations in one variable while I was lecturing on solving systems of equations. Oh boy . . .

But Lucy didn't seem to mind. Her focus was completely on "learning the rules." Before long, she was meeting with me every weekday. Perhaps my biggest jaw-dropping experience was when Lucy shared that she was studying 3.5 hours a night. Wow. It was right about then that I was on a mission too: figuring out how I could bring Lucy to the next level. I tried nudging Lucy to consider concepts as well as memorizing mechanics, but that really didn't seem to do much.

But Lucy was developing yet more strategies of her own. And she was learning more from what I modeled than what I said. For example, each time after she finished solving a problem with me jumping in to correct mistakes along the way, I'd summarize all the errors she'd

made. But soon she would jump in before I had a chance and summarize them herself.

Lucy started making good progress. In fact, our office discussions had somehow caught up with my lectures. Not that Lucy was performing well on exams. Since we'd met she scored a D on an exam, but nonetheless, her scores were improving (from a 35% to a 62%). I give a lot of tests—eight in all—so there was actually still enough points left in the course to have hope.

And hope was what I clung to. I'd seen several other students turn things around over the years. Students I'd decided would never make it, and they'd proven me wrong. I wasn't going to make the same mistaken diagnosis with Lucy.

It was when Lucy passed a quiz that she and I both got excited. She scored another D on the next test, but it was an even higher percentage than her previous test score. And her work during office hours was amazing. For example, Lucy could now solve quadratic equations by factoring, completing the square, and the quadratic formula. And fast!

But on the next test, Lucy scored a super-low D. Totally in the wrong direction. But it didn't make sense. I knew Lucy understood more than that. I was dreading the conversation we would have the next office hour, anticipating that she might want to give up.

But I was worried about nothing. Lucy arrived, ready to work harder than ever. In fact, from that point on, she studied with an intensity I'd never seen in another student. Did you see the movie "Grit?" Like that. Cubed.

On the next test, the hardest material of the semester (rational expressions and equations), Lucy got a C. And that was the turning point for me. From that point on, I had no doubt Lucy would pass the course, which she did. Barely point-wise. But knowledge-wise, she'd more than passed the course. And in terms



of dedication? She aced it beyond all the thousands of students I've ever had. Truly inspiring.

Even though I have various reasons why I teach, that semester Lucy's success stood out as the main reason by far, although I wasn't able to immediately pin down why. For a while, I thought it was because I'd made a difference in her life. But upon more reflection, I realized it was the gift of *witnessing* Lucy having utter faith in herself and doing whatever it took to succeed. To think that she'll be able to lean into that faith in hard times throughout her life is a truly wonderful thing.

Lucy's determination and eventual success sparks many inquiries, but two stand out in my mind. First, I wonder how many other students with weak mathematical backgrounds could succeed if they tried as hard as Lucy. I suspect almost all, which makes me wonder how many of those students would actually give it a shot if they were as certain as Lucy that they could do well if they just "learned the rules" by putting in 5.5 hours of classroom visits, office visits, and study time every day. This may seem like an impossible time commitment for many of our students, but Lucy pulled it off, despite taking three other classes, working two part-time jobs, and commuting as much as two hours per day.

Second, I wonder about the tipping point of motivation. What invites a student to totally commit to learning the material? As dedicated as Lucy became, it was only after doing poorly on a couple of tests that she made big changes. But for many students, low test scores would nudge them toward giving up, not trying harder. We've all had students like Lucy who have turned things around. What were their motivations? For some, it's getting accepted to a four-year college, on condition they pass their math class. For others, it's realizing they'll slip below a unit requirement for insurance or some such. For still

others, it's realizing that we instructors care about their success, perhaps because we invited them to our office hours.

Thanks to Lucy, I've reached out to more students, both those who seem like they don't care and those who have incredibly weak math backgrounds. Sure, many students decline my office-hour invitations, but some take me up on it. And, sure, some who come by don't do much more than that, which means their grade doesn't change much either. (Office visits are no substitute for homework completion, for example.) But others do make significant changes. Maybe not after one office visit. Sometimes the true motivation kicks in weeks later. And a lot of times the true motivation doesn't seem very tied to me at all.

In many cases, these success stories are much like Lucy's. I might play a role in getting things rolling, or be of help with tutoring math skills, but it could be that my main contribution is being a witness to their faith and commitment. On the students' side of the fence, it's a powerful thing to put yourself on the line and know someone's hanging in there with you, ready to catch you when you fall and eager to celebrate when you succeed. And on our teaching side of the fence, it's awe-inspiring to witness the transformation that can occur when a student digs in deep and goes for it.

## Calendar

May 25-27, 2011, OCMA  
Annual Mathematics  
Conference, Orillia, ON,  
Canada. Contact Paul Balog.

August 4-6, 2011 MAA  
MathFest, Lexington,  
Kentucky.

September 10, 2011,  
UMATYC Conference, USU-  
College of Eastern Utah,

Price, UT. Contact Henry  
Zwick.

September 24, 2011,  
WisMATYC Annual Meeting,  
Marian Univ, Fond du Lac,  
WI. Website: [wis.matyc.org/  
FallConferences/index.htm](http://wis.matyc.org/FallConferences/index.htm)

November 10-13, 2011, 37th  
Annual AMATYC  
Conference, Austin TX.  
Contact: AMATYC Office,  
[amatyc@amatyc.org](mailto:amatyc@amatyc.org)

**December 9-10, CMC<sup>3</sup>  
Conference, Monterey  
Portola Hotel and Spa.  
Monterey, CA. Contact:  
Barbara Illowsky, (408)  
864-8211, email:  
[illowskybarbara@deanza.edu](mailto:illowskybarbara@deanza.edu)  
u**

March 22-25, 2012 ICTCM,  
Orlando, FL. Website: [http://  
ictcm.pearsonctc.net](http://ictcm.pearsonctc.net)

Jay Lehmann

Editor

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