California Mathematics Council Community Colleges

2016 Monterey Conference Announcement

Katia Fuchs, President Elect, City College of San Francisco

The 44th Annual CMC³ Fall Conference will be held this year on Friday December 9th and Saturday December 10th at the Hyatt Regency Monterey Hotel and Spa. We are looking forward to yet another fantastic conference! At this time there are still many details to fill in, but much has already been determined.

2016 will be our fourth year at the Hyatt Regency, and we are happy to once again be able to hold all our conference activities in the upstairs area of the conference center, rather than in the basement. This allows our session rooms to be a little bit bigger, while still keeping us all in one place.

Our evening shuttle service to downtown Monterey has been proving to be very popular and will be running again this year, though most likely only on Saturday evening, with a possibility of extended hours. We will be able to report more as the conference draws near.

Our room rate starts at $130/night for double occupancy (with a slight increase in fee for a third or fourth occupant), and reservations can be made even now at https://resweb.passkey.com/go/2016CMC3 . For more details about the amenities at the hotel you can go directly to their website, at http://monterey.hyatt.com/en/hotel/home.html .

This year we will return to having a keynote speaker on Friday night. Spiros Michalakis holds a B.Sc. in Mathematics with Computer Science from MIT, and a PhD in Applied Mathematics from UC Davis. Currently at Caltech, he splits his time between research on quantum many-body physics and outreach to the public. He has worked with Google to design qCraft, a mod introducing quantum mechanics into the popular video game, Minecraft. His collaboration with Jorge Cham, creator of PHD Comics, has produced popular animations on different aspects of quantum science, such as Quantum Information and

(see "Monterey Conference" on p. 3)

Table of Contents

Executive Board & Special Committees

President: Joe Conrad, Solano Community College, (707) 864-7000 x 4372, Joseph.Conrad@solano.edu

Past President: Mark Harbison, Sacramento City College (916) 475-9461, harbism@scc.losrios.edu

President-Elect: Katia Fuchs, City College of San Francsico, (415) 452-5395, efuchs@ccsf.edu

Secretary: Tracey Jackson, Santa Rosa Junior College, tkkjackson@yahoo.com

Treasurer: Leslie Banta, Mendocino College, (707) 467-1053, lbanta@mendocino.edu

Members-at-Large:

Adjunct Advocate: Jen Carlin-Goldberg, Santa Rosa Junior College (707) 527-4746, jcarlingoldberg@santarosa.edu

AMATYC Liaison: Mark Harbison, Sacramento City College (916) 475-9461, harbism@scc.losrios.edu

Articulation Breakfast: Steve Blasberg, West Valley College (408) 741-2564, steve_blasberg@westvalley.edu

Awards Coordinator: Shawn Lanier, Woodland Community College (530) 661-5787, slanier@yccd.edu

Business Liaison: Dean Gooch, Santa Rosa Junior College, (707) 527-4704, dgooch@santarosa.edu

Campus Reps Coordinator: Shawn Lanier, Woodland Community College (530) 661-5787, slanier@yccd.edu

CMC Liaison: James Sullivan, Sierra College, (916) 660-7973, jsullivan@sierracollege.edu

Conference AV Specialists: Larry Green, Lake Tahoe Community College (530) 541-4660 ext. drlarrygreen@gmail.com and Steve Blasberg, West Valley College (408) 741-2564, steve_blasberg@westvalley.edu

Fall Conference Chair: Katia Fuchs, City College of San Francsico, (415) 452-5395, efuchs@ccsf.edu

Foundation President: Mark Harbison, Sacramento City College, (916) 475-9461, harbism@scc.losrios.edu

MAA Liaison: Wade Ellis, West Valley College (retired) (408) 374-0741, wade25@sbcglobal.net

Membership Chair: Kevin Brewer, Solano Community College, (707) 864-7000 ext. 4396, kevin.brewer@solano.edu

Newsletter Editor: Jay Lehmann, College of San Mateo, (650) 863-5305, MathNerdJay@aol.com

Spring Conference Chair: Larry Green, Lake Tahoe Community College, (530) 541-4660 ext. 341, drlarrygreen@gmail.com

Student Poster Session: Jen Carlin-Goldberg, Santa Rosa Junior College (707) 527-4746, jcarlingoldberg@santarosa.edu

Spring Program Chair: Mark Harbison, Sacramento City College (916) 475-9461, harbism@scc.losrios.edu

Web Page Coordinator: Larry Green, Lake Tahoe Community College, (530) 541-4660 ext. 341, drlarrygreen@gmail.com

Follow us on Facebook

Volume 45, Number 2 Summer 2016

CMC³ Newsletter is the official newsletter of the California Mathematics Council, Community Colleges, and is published three times a year--in the spring, summer, and fall.

Mark Your Calendar:

44th Annual CMC³ Conference

December 9th and 10th, 2016

Hyatt Regency Monterey Hotel and Spa

Monterey Conference

(continued from front cover page)

Topological Quantum Computing. In his talk, he will discuss "Is space and time fundamental, or are both concepts derived from powerful, yet abundant, quantum correlations underlying the very fabric of reality?"

Saturday will feature another keynote speaker and our usual lineup of talks spread over six threads, with details still to be ironed out. We will have some slots available and love to have our own members present, so if you are interested in giving a talk in any area of community college mathematics, from basic skills, to statistics, to calculus, to methods or innovations in teaching, please submit a proposal on the website at: http://www.cmc3.org/conference/callForProposalsMonterey.html.

One other thing to keep in mind is the student poster session. Please encourage your students early this fall to develop a poster for presentation at the conference. More details will follow.

As we work on finalizing details, they will be posted on the conference website at www.cmc3.org/conference/Monterey16/Monterey16.html . We expect the conference registration form will be posted before the end of the summer.

We look forward to seeing you in Monterey for another fabulous fall conference!

The Pleasures of Problems

Kevin Olwell, San Joaquin Delta Community College

Summer 2016: Suppose $a, b \geq 0$. If the polynomial $f(x) = x^3 + ax^2 + bx + 1$ has three real roots, then $f(2) \geq 27$.

Spring 2016: The local youth soccer league is planning its annual tournament. The director has asked you to pair the teams for the first round of play. There are 20 teams. How many ways can the 20 teams be paired?

Solutions to the Spring Problem were submitted by Paul Cripe, Carlos Valencia, Fred Teti and Joe Conrad.

The solutions observed that in a 4-team tournament, Team 1 can be paired with any of the other 3 teams. After pairing Team 1,the remaining 2 teams must play each other: $P(4) = 3$. In a 6-team tournament, Team 1can be paired with any of the other 5 teams. Once Team 1 has been paired, the previous calculation shows are 3 ways to pair the remaining 4 teams: $P(6) = 5 \times P(4)$. When there are $2n$ teams competing, there will be $2n - 1$ pairings for Team 1. The remaining teams can be paired in $P(2n - 2)$ ways: $P(2n) = (2n - 1) \times P(2n - 2)$. A straightforward induction yields

$$P(2n) = (2n - 1) \times (2n - 3) \times \cdots \times 5 \times 3.$$

All are invited to submit a solution to the Summer 2016 problem either via email or US mail at the address below.

Kevin Olwell
San Joaquin Delta Community College
Agriculture, Science and Math Division
5151 Pacific Avenue
Stockton, CA 95207
kolwell@deltacollege.edu

President's Report

Joe Conrad, CMC³ President, Solano Community College

This is my second report as your president and I must admit that I had some trouble deciding what to write about, so I decided to discuss something not all the membership may understand, namely the presidential positions in CMC³. The way that we do the presidential process at CMC³ is that we have a sequence of three positions (president-elect, president, and past president) each with a two-year term. The job of president-elect is challenging! Essentially it is the president-elect's job to coordinate the Monterey conference. This includes arranging for speakers and presiders, making the program, ironing out the details with the hotel, and more. There is a lot to it, but it is pretty well-defined and the person gets to practice delegating skills. Our current president-elect is Katia Fuchs from City College of San Francisco.

The past president's job is to assist in the continuity of the organization. The past president has two basic jobs; namely, to be a member of the Foundation's board and to run the next election. The past president is most appreciated by the other officials as a source of institutional memory and as an example that you can survive being president-elect and president. Our current past president is Mark Harbison from Sacramento City College.

What about the president? There are some official responsibilities like signing any contracts, being the voice of the organization, and running board meetings. However, after spending two years as president-elect (and six as membership chair – another job with well-defined duties), I find I am not always sure about what else I should be doing or not doing. One thing I can safely assume to be part of the job is to be an advocate for the goals of the organization. These goals include having our conferences which are meant to help community college mathematics instructors to engage in professional development. (See other articles in this newsletter about the Tahoe and Monterey conferences.) The goals also include informing our members and others about current trends in the profession.

As part of doing these things, I recently attended a meeting of our county affiliate of CMC, the Math Educators of Solano County. I especially want to interact with our high school teachers during this time of transition to Common Core since, I believe, it will influence our curriculum and how we teach it in the near future. I encourage you to also be involved in these efforts. I also encourage any of you who have insights into this topic to consider speaking at the Monterey conference.

Finally, I would like to ask you to consider being part of the CMC³ board at some point in the future. There are other roles to play than being in the presidential cycle and I would recommend starting with one of those before tackling the presidencies. This organization is run by volunteers who have no more qualifications than you!

Math Nerd Musings: Making the Connection

Jay Lehmann, Newsletter Editor, College of San Mateo

Midway through my career, I had a candid conversation with an astute student. I was complaining that all the advice I was offering my students was falling on deaf ears. Without missing a beat, the student told me that I had to meet students on their own terms. He said that if I first showed students that I cared and understood them, they'd be more likely to listen. I'm sorry to say it took me years to take his advice to heart.

This semester I'm teaching a prestatistics course for the second time. It's a special opportunity to connect with students for two reasons. First, word hasn't gotten out yet that the course is the best deal in town, so the enrollment is low: only 24 students. Second, about half of class time is devoted to collaborative learning. During such activities, I have lots of one-on-one interactions, and with so few students, I've really gotten to know them well.

The student told me I had to meet students on their own terms. He said that if I first showed students that I cared and understood them, they'd be more like to listen.

As a result, students tend to carry my advice with more weight. If I approach a student and say that I've noticed the student's fallen off doing the homework, I'll hear the usual (true) story about why that's happened, but I'll also get a sincere promise that the student will get back on it. And opposed to my typical experience in other courses, the student will follow through.

Sometimes I won't witness my impact until weeks or months later. For example, after students had struggled with a test, I shared a personal experience about turning my life around and distributed a handout describing an exhaustive list of study practices to learn mathematics. Several weeks later, a student who had been getting Ds on tests earned an 80% (lowest B) on a test. I asked him what happened and he smiled, saying he had started looking over past quizzes and tests. This was relevant because I give cumulative tests, but his response didn't explain why he was doing so well on current material. He then proceeded to get As on the next three tests. I couldn't stand it anymore and asked him again what he was doing differently. Again, he smiled, saying he had started reading the textbook and attending Supplemental Instruction workshops.

If he were the only one making significant improvements, I would pass it off to an outlier. But other positive shifts are happening, including another student who was getting Ds is now passing tests, and the percentage of students completing demanding review homework assignments has grown from 50% to 87%.

So, what's the moral of the story? That a small enrollment and collaborative learning are the ticket?

Well, we generally don't have the luxury of having small enrollments in our classes, but we do have control over how much time we devote to collaborative learning. And there are a myriad of benefits to this pedagogy in addition to becoming well-acquainted with our students.

But even if facilitating collaborative learning ins't your thing, there are other ways to connect with students. Arriving early to classes and striking up conversations, sharing an experience, joke, or song during lecture, or even the simple act of saying goodbye to students (rather than packing up) as they leave the classroom can build bonds.

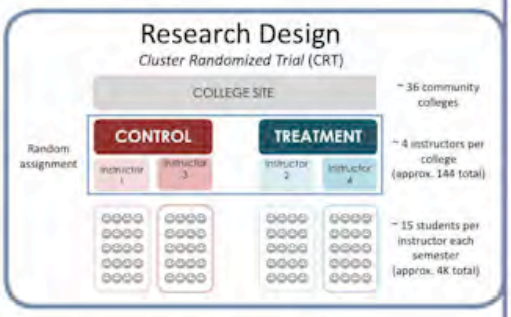
Connecting with students on their own terms will afford you a lever ten times your past strength in inspiring change in your students. It's not too late. Connect with a student today!

ATTENTION: Algebra Instructors, Chairs, and Deans

Elementary Algebra + Khan Academy = ???

A project funded by the U.S. Department of Education

WestEd
WestEd.org



2016-2017

An exciting opportunity to participate in a professional development and research project

A rigorous study of the efficacy of khanacademy.org resources in California community college Elementary Algebra

Now inviting instructors to participate:
http://khanstudy.wested.org/learn-more

Disclaimer: The contents of this document were developed under grant number R305A140340 from the U.S. Department of Education, Institute for Education Sciences (IES). However, the contents do not necessarily represent the policy of the department, and you should not assume endorsement by the federal government.

Questions? Email us at khanstudy@wested.org

What's Happening at Foothill College

Debbie Lee

The Foothill College Math Department has been busy, busy, busy!

The enrollments in our math classes have gone up almost every year since 2007, and we now boast 20 FT faculty and about 26 adjunct faculty. To accommodate our STEM courses, a new PSEC (physical sciences and engineering center) building was built in 2013. This new building is housed where the old vet tech program was located. During the construction, you might have thought that you were out in horse country with the wind gently wafting the aroma of umm ... ripe soil.

Since 2007, we have offered some new programs to our students.

First, we have created a Summer Bridge program. This is an intense two-week program that helps students brush up on their math skills. The program is open to students who place into intermediate algebra and below. At the end of the program, the students are allowed to take the placement test again. Most students improve their scores enough to move them up at least one level higher than the original placement.

Second, since 2012, we have offered students an alternative statistics pathway in the form of a 2-quarter, 15-unit Statway sequence, which satisfies the general education math requirement for the Foothill Associate's Degree. Both the UC's and CSU's now accept Statway as satisfying the quantitative reasoning requirement. Statway is not recommended for students who are majoring in a STEM field.

Third, we have created an honors Math 1A (Differential Calculus) course along with a 1-unit Math 1A honors seminar. In addition to the regular Math 1A curriculum, the honors work emphasizes a deeper study of differential calculus via the study of proofs using analytic techniques, real-world problems, and special applied projects.

We are currently awaiting news from C-ID regarding the descriptors for basic skills math (beginning and intermediate algebra) and the prerequisite necessary for introductory statistics. We are also eager (who isn't?) to see how the common core math standards will affect our incoming students in a couple of years.

What's Happening at Shasta College

Jennifer McCandless

The Shasta College math department has been very busy addressing the dismal through-put rate for basic skills math students. We have two new programs that were implemented Fall 2015: Pre-Statistics and Math My Way. Below is a brief description of each program.

Pre-Statistics (Math 114): Four full-time instructors received the Path2Stat training through the California Acceleration Project then subsequently created this new 5-unit course. This course is an alternate path through Beginning and Intermediate Algebra and is for students who only need Statistics (Math 14) for their transfer-level math requirement. We offered four sections in the fall semester and are offering five sections this spring. The course was impacted in the fall, which is why the number of sections was increased for spring. Statistics instructors are reporting that students who successfully passed Math 114 in the fall are well-prepared for Math 14 this semester.

Math My Way: A team of instructors have created a self-paced, modularized program for students who are entering mathematics up to four levels below transfer level. With one-on-one instructor attention along with the use of ALEKS and a textbook in a lab-based environment, this program enables students to progress through the equivalent of two basic skills math classes in as little as eight weeks. The initial survey results are extremely positive, and we have just begun tracking the students that have persisted to the next level.

The math department is excited about both of our new programs and are looking forward to sharing our initial data at an upcoming CMC^3 conference.

We also began offering a Math Camp bridge program in Summer 2014, Supplemental Instruction in Fall 2015 and embedded tutoring Spring 2016.

The 20th Annual CMC^3 Recreational Math Conference in Lake Tahoe

By Larry Green, Lake Tahoe Community College

Last month we got to enjoy another wonderful conference. The 20th annual recreational math conference in Lake Tahoe was one of adventure and learning. The adventure occurred for all those who drove up on Friday afternoon braving the heavy snow and curvy mountain roads to drive over the pass. The learning occurred after arrival where we were treated with amazing applications of the mathematics that we all teach each day.

The conference began with keynote speaker Bruce Armbrust explaining the various ways that we have identified thousands of planets outside of our solar system. We learned about how Kepler's laws are observed and how we can not only know that the planet exists, but how massive it is, how far it is from its star, and how long the alien year lasts. Mathematics is the tool that allows us to determine all of these planetary facts.

Immediately after the keynote talk, we went to the suite for the third annual CMC^3 Foundation Gala. This helped raise money for student scholarships. We partook of plentiful food and drinks and reconnected with our colleagues who came to support students throughout Northern California.

On Saturday morning the sky had cleared and the snow sparkled outside. Inside, we learned about prime numbers and triangles. We connected with our spiritual side mathematically and used math to obtain social justice, liberty, and prosperity. Also, we can now defend ourselves as we use mathematics to understand the art of self-defense. The morning sessions were followed by lunch and then Paul Zorn's presentation on extreme calculus where we learned some cool applications of Newton's Method. After the Saturday keynote, we enjoyed more sessions, where we were entertained with dazzling triangles, Gaussian Periods, Kepler's Third Law in Non-Euclidian spaces, and the Chinese abacus. The grand finale of the conference was our student speaker, Nick Saal (in photo on left, along with Nick's professor, Dave Ohlsen) from Santa Rosa Junior College, who showed us how to analyze the sum

of a series even when it fails to converge.

Next year, based on overwhelming popular demand from you all, the 21st annual Tahoe Recreational Math Conference will take place at Lake Tahoe Community College on April 21 and April 22, 2017. Look for more information about it in future newsletters.

Pi Day Contest 2016

Judith Howe, Sacramento City College.

We had a fun time at the contest. At first, only four of the six people that had signed up actually showed, but fortunately two more contestants signed up just before we started, so we were back at six.

Each contestant wrote as many digits of Pi as they could remember on the white board in LR220, while the other contestants waited in the hallway next to the classroom. Some contestants took their time; others wrote quickly. After an hour, we had a winner.

1st place: Travell Criner with 133 digits memorized (he won a $10 print card, an apple pie, a t-shirt, an SCC 100th anniversary bag and USB car charger, and a Pi pencil)

2nd place: Joshua Pauly with 92 digits memorized (he won a $5 print card, an SCC 100th anniversary bag and USB car charger, and a Pi pencil)

3rd place: Faren Li with 81 digits memorized (he won a $1 print card, an SCC 100th anniversary bag, credit card holder, and a Pi pencil)

All of the other contestants received Pi pencils too.

Please consider putting one or two newsletters in the copy room for other instructors to read.

Our contestants with the winning entry on the white board.

Founding Board Member Sr. Clarice Sparkman Remembered

Wade Ellis, West Valley College (retired)

Sr. Clarice Sparkman died January 10, 2016 in Houston, Texas. In 1972, she was a founding Board Member of the California Mathematics Council Community Colleges (CMC^3). Sister Clarice earned degrees in Mathematics from Mt. St. Mary College in Los Angeles (B.A.) and from the University of Texas at Austin (M.A. and Ph.D.). During her teaching career, which

spanned 40 years, she taught first grade through university level including positions at both the University of San Francisco and Santa Clara University and for 30 years at San Jose City College. Sister Clarice was also a founder of AMATYC and its second President. She was a frequent speaker at conferences within California and, through AMATYC, across the nation.

Her focus was on developing and improving developmental mathematics education curriculum. Her desire to help students was evidenced in her development of innovative instruction techniques and by her own words, "I wanted to work with students, not sit in a corner somewhere and write." Because of her interest in developmental mathematics, she was instrumental in professional development and trying to understand what would make developmental mathematics students succeed: "We are missing taking care of remedial students . . . [with too] little thinking."

Her lifelong romance with mathematics is reflected in her statement that "Mathematics is life fulfilling. You have it and use it all of your life. You are always learning." She was very appreciative of CMC^3: "It's wonderful to have the ability to learn and grow at the [CMC^3] Conferences."

In 1995 Sr. Clarice received the much deserved CMC^3 Distinguished Service Award recognizing her contribution to our organization. This annual award is given to a past board member who has dedicated years of service in the CMC^3 organization. This service spanned those years when community college mathematics faculties were developing a greater professional status in the mathematics community and that greater status is reflected in the frequent references in the national press to the importance of community colleges in maintaining the nation's economic health.

Sister Clarice will be missed.

The CMC^3 Oral History Project includes comments by Sister Clarice at: http://www.cmc3.org/resource.html → Resources → FLV:FLASH.

KELLOGG INSTITUTE 2016: JULY 16–29

Sponsored by the National Center for Developmental Education, the Kellogg Institute for Adult and Developmental Educators and Learning Skills Specialists has offered an advanced professional development and certification program for those seeking to further their knowledge in the theory and best practices of postsecondary developmental education since 1980. The 2016 Kellogg Institute is scheduled to take place July 16 – 29 on the campus of Appalachian State University in Boone, NC.

Grounded in theory and research, Kellogg Institute seminars combine expert-led presentations with structured learning experiences exploring practical applications to promote student persistence and retention. The summer residency provides a dynamic living-learning community with opportunities for sharing ideas. Discussion of national policy issues related to developmental education is an important component of the Kellogg experience as well.

For the 2016 Kellogg Institute, the 2-week residency will focus on the most current issues and methods in the field, including:

- Implementing innovative models for retention and completion;
- Connecting courses and support services;
- Applying technology for student success; and
- Understanding characteristics of diverse learners.

Developmental Education Specialist Certification is available to those who enroll in a 3-credit-hour graduate course and design a practicum project.

Kellogg alumni comprise a network of scholar-practitioners, empowered to advocate for best practices in developmental education and student success at their home institutions and beyond.

Who We Are: The National Center for Developmental Education (NCDE) provides instruction, training programs, research, and other services consistent with the purpose of developmental education and the missions of Appalachian State University and the Reich College of Education. These services are provided to a national audience of professionals dedicated to serving underprepared and disadvantaged college students. In addition to the graduate programs in developmental education and the Kellogg Institute, the NCDE also provides specialized workshops and training sessions on a contract or fee basis. The content of these sessions is designed according to the professional development needs of a particular audience.

Applications for the 2016 Kellogg Institute are now being accepted. For more information, visit www.ncde.appstate.edu/kellogg or e-mail kellogg@appstate.edu
Or call (828) 262-2805

Through the History Glass

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

This column is installment 3 of 3 on the names of the conic sections that we use today.

The names "parabola," "ellipse," and "hyperbola" that Apollonius chose for the conic sections come from the Pythagorean problem of the application of areas. (See [1, pp. 150–154], for example.) Let us see why.

To begin, if we divide a cone in half by a vertical plane, then the intersection of the plane with the base of the cone, labeled BC in the following figures, is called the *diameter* of the cone, and the triangle ABC is called the *axial triangle*. (See [2, pp. 134–141].) To obtain a conic section, we then cut the cone by a plane such that the intersection of the cutting plane with the base of the cone is a line DE that is perpendicular to BC (or BC produced). There are three possibilities for how the cutting plane might intersect the axial triangle: the cutting plane might intersect the axial triangle in a line PM that is parallel to one side of the axial triangle, or PM might pass through both sides of the axial triangle, or PM might intersect only one side of the axial triangle and, when produced, the other (inverted) side.

To characterize the different conic sections, Apollonius picked an arbitrary point Q on the section of the cone. Now, let QV in the cutting plane be perpendicular to PM, and draw PL perpendicular to PM so that PL satisfies one of the following ratios. The length PL is called the *parameter* or *latus rectum* of the section.

If PM is parallel to one side of the axial triangle, then

$$PL : PA = BC^2 : BA \times AC;$$

in the other two cases,

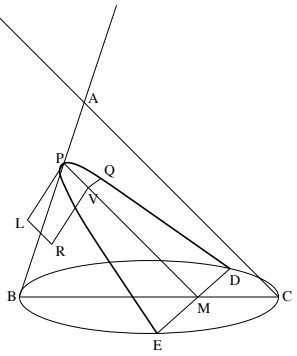
$$PL : PP' = BF \times FC : AF^2,$$

where P' and F are shown in the figures below.

In the following figure, PM is parallel to AC, and Apollonius shows that

$$QV^2 = PL \times PV;$$

in other words, the area of the square on QV equals or is *applied* to (Greek: *parabola*) the area of the rectangle LV. (See Heath [2], for example, for details.)



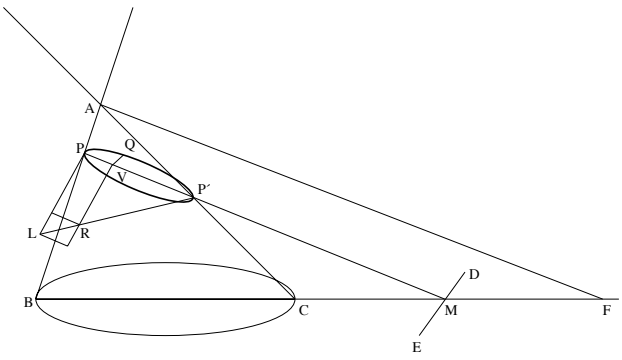
If we let x denote the abscissa PV, y denote the ordinate QV, and p denote the parameter PL, then, in modern notation, the parabola has equation

$$y^2 = px.$$

In the next two cases that are shown in the following figures, Apollonius shows that

$$QV^2 = PV \times VR.$$

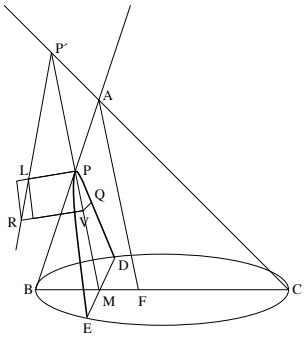
In the following figure, we see that the area of the square on QV *falls short* of (Greek: *ellipse*) the area of the rectangle LV by the rectangle LR.



In this case, the ellipse has equation

$$y^2 = px - \frac{p}{d}x^2,$$

where d denotes the diameter PP' of the conic section. In the following figure, we see that the area of the square on QV *exceeds* (Greek: *hyperbola*) the area of the rectangle LV by the rectangle LR.



In this case, the hyperbola has equation

$$y^2 = px + \frac{p}{d}x^2.$$

Thus, this is how Apollonius came to name the conic sections "parabola," "ellipse," and "hyperbola." He then established all of the properties of the conic sections that we teach in college algebra today, and then some.

Finally, it is important to note that Apollonius carried out his investigations entirely using the language of geometry, and that there is no evidence that he employed algebra of any sort.

———————◇———————

Previous columns are on the Web at <http://ms.yccd.edu/history-glass.aspx>. Thoo is coauthor with Amy Shell-Gellasch of *Algebra in Context: Introductory Algebra from Origins to Applications*, Johns Hopkins University Press, Baltimore (2015), that presents introductory algebra using history as the vehicle.

References

[1] Thomas Heath (Sir), *A History of Greek Mathematics, Volume I: From Thales to Euclid*, Dover Publications, Inc., New York (1981).

[2] Thomas Heath (Sir), *A History of Greek Mathematics, Volume II: From Aristarchus to Diophantus*, Dover Publications, Inc., New York (1981).

CMC^3 History Quiz, Part 6

Mark Harbison, Sacramento City College

1. Rearrange the letters "Ordinal Bell" to form the first and last name of the 2008 Tahoe keynote speaker from CSU Fullerton: _____ _____.

2. In what year did Earl Swokowski give the Monterey keynote talk *The Changing World of Undergraduate Mathematics* ?

3. Multiple Choice: In 1994, who gave the first CMC^3 Monterey talk with the word "Internet" in the title ? a) Phil Smith (ARC) , b) Joe Franko (Mt. S.A.C.) , c) Dick Auffman and Dick Nation (Palomar C.) , d) Rob Knight (EVC) , e) Glenn Ceasar (SRJC).

4. "Common Core" was in the title of a CMC^3 Monterey talk in which two years (so far)?

5. Multiple Choice: G. D. Chakerian, who gave the 1976 Monterey keynote talk on *Thinking Geometrically,* was from which university? a) UC Berkeley , b) UC Santa Cruz , c) UC Davis , d) San Jose State U. , e) Humboldt State U.

(see "Answers to History Quiz" on p. 17)

Foundation Report

Mark Harbison, Sacramento City College

The CMC^3 Foundation is proud to award three students with scholarships for the 2015–16 academic year. Thanks to the many generous CMC^3 donors, especially at the annual Monterey and Tahoe conferences, the Foundation continues to provide a total of $6000 per year to high-achieving students with great mathematical potential. It is simply amazing to see how much talent they have.

First place ($3000) goes to **Katherine Kays-Hoepker**, a Sierra College student in

Rocklin, CA. Earning all A's in eight courses from College Algebra to Linear Algebra and Discrete Mathematics, she was nominated by James Sullivan, Dan Balaguy and Ken Johnson. Katherine has tutoring experience, scored high on the AMATYC Student Math League exam, has earned awards such as the "best math student at Sierra College" award, and has been president of the S. C. Math Club for several years. She stands out because of extensive "proving theorems and deriving identities".

Second place ($2000) goes to **(Nancy) Yizhuang Kang** of Las Positas College in

Livermore. She also has a 4.0 GPA after taking 73 ½ academic units at LPC, including Statistics and Calculus III. She has been a student trustee for the Chabot-Las Positas CC District. Among other things, her letter of recommendation said that "Nancy is more than just an outstanding student; she is an outstanding person who possesses sound and solid judgment, excellent leadership qualities, a drive to excel, and personal pride in her abilities."

Third place ($1000) goes to **Ashley Rosas** (in photo on right) of West Valley

College in San Jose. Not only did she earn all As in both high school and college (including seven courses from Pre-Calculus to Discrete Math and Linear Algebra), she did so despite being uprooted to move to Mexico from ages 12 to 16. Even though she started off in ESL classes

and needed to make up missed work, she was high school valedictorian and President's Education Award winner. Now, she and her Puente Program mentor attend lectures offered by the Stanford University Mathematics Department.

Many of you have purchased t-shirts, hats and other items from the CMC^3 Foundation at the recent Recreational Mathematics Conference in Tahoe. Thank you for supporting the scholarship program. All of the students with their nominators and letters-of-recommendation writers are very grateful. We couldn't have scholarships without you.

The next major opportunity to support the Foundation is the Fall Conference in Monterey on Dec. 9th and 10th, 2016. But it is not necessary to wait that long if you are feeling generous earlier than that. Donations are welcome at any time, 365 days per year. These extraordinary students deserve our support.

The CMC^3 Foundation is a nonprofit charitable organization under section 501(c)3 of the Internal Revenue Code. Contributions are tax deductible to the extent allowable under federal law (as long as no goods or services are provided in exchange for the donation). Our Tax Identification Number is 94-3227552. Receipts will be issued.

Cash donations can be made in three ways:

- By mailing a check to our treasurer, Leslie Banta at Mendocino Community College, 1000 Hensley Creek Rd, Ukiah, CA 95482;
- At the time that you register for a conference (please use a separate check, but mail it in the same envelope as your registration form);
- In-person at one of our conferences, either by check, cash, or credit card.

Thank you again for supporting student scholarships through the CMC^3 Foundation.

Also, thanks to this year's judges: Ken Seydel from Skyline College, and Terry Shell and Karl Smith from Santa Rosa

Junior College, with a special thanks to Karl for hosting a very nice reunion.

Support for Faculty Teaching Online

Barbara Illowsky

Calling all faculty who teach (or want to teach) online! In my position on the CCC Online Education Initiative I formed a "support group", available to all California Community College full and part-time mathematics faculty. We're hosting this group on BaseCamp so that we can have discussions and a repository for files. The aim of this informal group is to share with each other and support each other in a safe place where no one will be judged or evaluated. So far, over 80 faculty have joined. We've discussed formative assessments, virtual office hours, introductory assignments, and other topics. We also post regulations and position statements relating to distance education and professional development opportunities.

Some of us in the group have been teaching online for many years. Some of us are interested in teaching online but have not done so yet. Others have some experience. The basic "entry requirement" is that you are interested in learning and/or sharing about distance education in mathematics and that you will be supportive, not judgmental in your postings.

If you'd like to join, email me: billowsky@cccOnlineEd.org

Answers to History Quiz, Part 6

(continued from page 14)

1. **Bill Leonard** gave the keynote talk *The Great Human Computer Simulation and a Few Mathematical Gems* in 2008 in Tahoe.

2. Earl Swokowski was the CMC^3 **1977** keynote speaker for Monterey.

3. The five choices listed have **all** given a talk relating to the Internet in order: 1994 **Phil Smith**, 1995 Joe Franko, 1996 Dick Auffman and Dick Nation, 1997 Rob Knight, 2008 Glenn Ceasar.

4. In **2014**, Larry Green (LTCC) gave the talk *All About the Common Core & What It Means to Our Math Programs*; And in **2013**, Diane Mathios (the CA Teacher Advisory Council) gave the talk *The Impact of Common Core and the Community Colleges*.

5. G. D. Chakerian has been at **UC Davis** from 1963 to present.

Bull: Coding in Community College Mathematics?

1 Ghana 1962 and Mountain View 2016

Bull's first teaching job was in 1962 at a high school in northern Ghana. The O Level curriculum included arithmetic as well as algebra and geometry, and rather than doing these subjects sequentially, as is the American practice, they were mixed together in each year of teaching. One of the small challenges for a Californian was that in 1962 Ghana still used the traditional English money system of pounds, shillings and pence: twelve pence to a shilling, twenty shillings to the pound, and things like "nine half-crowns less one and six-pence is a guinea"; a guinea was a monetary unit commonly used for pricing services, but with no corresponding coin or note. So, using this money system, here is a typical arithmetic problem involving profit and loss taken from a small book of O Level arithmetic exercises (Baker, 1956).

> **Example 1:** *A dealer buys an article for £2 10s and sells it for £3 7s. 6d. What is his percentage profit?*

$$\begin{aligned} \text{The actual profit} &= \text{£3 7s. 6d. - £2 10s.} \\ &= \text{17s. 6d.} \\ \text{Profit per cent.} &= \frac{\text{17s. 6d}}{\text{£2 10s. 0d}} \times 100 \\ &= \frac{7}{20} \times 100 = 35 \text{ per cent.} \end{aligned}$$

That will give something of the flavor of the exercises, although this one is simpler than many, being the first example in the profit and loss section. It was also interesting to learn that illiterate market women could be very proficient doing calculations in pounds, shillings and pence. So, in Ghana as in most of the world in 1962, arithmetic, whether mental or with paper and pencil, had a purpose. It could be used every day. Community college mathematics instructors frequently complain now that students are woeful at

arithmetic, and especially mental arithmetic. Surely part of the reason is that there is so little opportunity outside of the demands of mathematics classes to use arithmetic. For the traditional question: "when will I use this in the real world?" arithmetic ranks high in the "never" column. Of Course, we do think arithmetic, or at least some understanding of and facility with the number system is important within mathematics. But outside our courses, the story is different.

Fast forward to Mountain View in 2016, where Bull's ten-year old grand-niece is working to program her Lego robot using Mindstorms and all of this as part of a STEM project for school. She is really comfortable with "if-then-else" ideas and has had to deal with the idea of the negation of a disjunction. We can make three comments about this little story: first, the grand-niece must not be unusual in having experienced some kind of programming in her elementary school experience. Secondly, the experiences of children her age will probably be quite diverse. Third, unlike doing mental or pencil and paper arithmetic, she knows that what she is grappling with is important. To be fair, it should be said that she also likes arithmetic, partly because she gets to teach her younger eight-year old brother, who is in turn is fascinated with numbers. And also to be fair, part of the reason she knows that programming is important is that her dad works in software quality assurance, even though her appreciation of what he does is developing; her first idea on being told that her dad found "bugs" was that he must be an entomologist.

The point of the two little stories is that programming or coding is something that many of our incoming students will think is important and will have experienced. They will see programming as important because they see it all around them, and if they are STEM students, they will know that it is important for their future studies. They may also see that arithmetic is important because it is part of mathematics courses, but not because it is important in the world outside math courses, unlike in the 1962 Ghanaian scenario.

2 Programming, Coding?

That programming and coding is relevant, that more and more of our incoming students will have had some experience coding and that the world of programming intersects with our mathematics curriculum (only hinted at in the stories above) would seem to constitute strong reasons for attempting to include coding in the community college curriculum. Moreover, the idea of incorporating programming in mathematics teaching is not new: from people who have been keeping up with the use of technology in mathematics education one hears that thirty years ago (or more?) there have been people arguing for the incorporation of programming or coding in mathematics teaching. Moreover, in upper division courses in mathematics and statistics, students will be expected to learn some kind of language to pursue their studies. So why do we see so little, and so little perhaps

especially in community college teaching? Is it just that community college teachers are permanently stuck in "what we have always been doing", what we know, slogging through the textbook, covering the topics? Perhaps; that picture is certainly true to some extent. However, there may be some inherent difficulties involved in incorporating programming or coding. Two interconnected reasons come to mind:

- Instructors cannot know what programming experience students have had, and these experiences can be diverse.
- Instructors are worried that teaching the necessary programming or coding skills will intrude on the core of what needs to be done.

Diversity of Coding Experience

If one begins to look at what kinds of things are done in schools in one way or another in the quest to teach programming, one is immediately struck by how much there is and how diverse it is. A rudimentary search of the various options that many of our incoming students may have experienced includes:

- *Scratch* (`https://scratch.mit.edu/scratch_1.4/`)
- *Hour of Code* (`https://code.org/about`)
- *Khan Academy Hour of Code* (`https://www.khanacademy.org/hourofcode`
- *Racket* or *DrRacket* (`http://racket-lang.org/`)
- *NetLogo* (`https://ccl.northwestern.edu/netlogo/docs/`)
- *Bootstrap* (`http://www.bootstrapworld.org/materials/spring2016/index.shtml`)

This list is by no means complete, but it does give some idea of the diversity of approaches and the diversity of what students may have been exposed to. You get the same sense of diversity in the way in which programming and coding is being treated in schools by going to blogs devoted to primarily K - 12 education. Even the blogs themselves are diverse! Some of them are sponsored by organizations doing research and developing curricula, and some of them are the personal blogs of practicing teachers, and some are blogs about blogging. Here is a very small sample devoted at least partially to the issue of "coding in the classroom".

- *edutopia* (`http://www.edutopia.org/blog/coding-in-the-common-core-tara-linney`)
- *Coding in Math Class* (`https://codinginmathclass.wordpress.com/`
- *The Edublogger* (`https://www.theedublogger.com/`) (Search for "coding")
- *Math and Coding* (`http://www.mathandcoding.org/`)

Since programming is not a part of the curriculum, students attending community colleges are likely to have extremely diverse backgrounds in what they have done and know, even if they think that being able to code is a good thing. Some of them will have already written their own app, and others not a line of code. Perhaps thankfully, there is nothing as structured as a prerequisite of programming, and generally, our placement tests do not test the previous experience of students for programming. Another aspect to the diversity of experience is whether students who have had experience in one type of coding can easily generalize that experience to deal with a difference programming scenario. Are

there general skills that are learned; one would hope so, but one does not know. Are there aspects of the coding that is appropriate for college level courses for which the experience in elementary and secondary schools is inadequate? Thus, the diversity in experience amongst students and what that experience is likely to be present problems for a classroom teacher. One solution is to incorporate possible coding within projects where those students who know how to code can use their abilities, and those who do not, do something else. For some teachers, this option will introduce an unwanted complexity in course administration. It may be relevant to devise some measure of what skills students know. On this, see the section below on Ideas: Serving Suggestions.

Teaching Too Much Code?

The curriculum for term long courses that we typically teach is sufficiently great that having to include anything else, without deleting something that is traditionally there will be seen as problematic for many teachers. The time spent on "new material" has to carry more than its weight to justify what it is doing. Otherwise, the response from instructors will be that the students should be taking a computer science course, and not a mathematics course. So the question becomes: what is "too much" and how do we detect when the effort will not be worth it? The answer is not simply one of added material to "cover". Is it possible that things can be done that use students' possible previous coding experiences and interest as an aide in learning what is already in the curriculum? Can things be done using programming or coding that fit in with what we are teaching? To make an analogy: we devote considerably less time on the details of using tables of trigonometric functions or tables of binomial distributions than we once did. Teaching how to use tables is for the most part a distraction from the main material, and most teachers are happy to see that task go. However, some argue that students do learn an attention to detail by having to deal with tables, and that (by contrast) getting the "answer" by the push of a button is too easy. Arguing in the opposite direction: one of the challenges that coding presents to many students is exactly that attention to detail which some argue is lost by not having to cope with reading tables. There is a logic to programming that fits in very nicely with most of what we teach. Even with these small examples, one can see that an instructor would have to think carefully about how and where coding of some kind should come in. The next section gives some suggestions.

3 Ideas: Serving Suggestions

In this section the open ended nature of these Bull articles comes to the fore: the ideas here are what comes to one instructor with some considerable experience. Given that there appears to be relatively little public discussion of programming in the community college curriculum we cannot do otherwise. Hence what is put here is primarily meant as a kind of spark or spur to further thinking. The ideas are put in three subsections that correspond to a rough division of the courses that are typically taught in community

college mathematics departments: the first subsection focuses in on pre-transfer level, the second on transfer level courses that are not in the traditional calculus sequence, and focuses on statistics, and the third has some tentative suggestions for the calculus sequence. The suggestions are not detailed recipes that have been tried out, but are rather general culinary suggestions; the cooks will have to work out the details. For any of the "serving suggestions" it makes sense to gather some data on students' previous coding or programming experience. This will attack the first concern that we as teachers have about using programming: that we know not from whence our students come. A second common theme to the suggestions is that programming experience of students need not result in writing a full blown program in a mathematics class. A full blown program or even small script to accomplish something may well be appropriate in some situations, but it may well be sufficient to make use of just some of the experience that students have gained through what ever they have done in their primary and secondary schooling. The third common theme is that the suggestions presume that teaching uses technology, and most often technology beyond the graphing calculator.

Pre-Transfer Level: Build on Free and Common

So, what is free, what is common? Starting with common (though not free): probably the most commonly used technology for teaching at this level is the graphing calculator, especially the TI series. These calculators have a programming facility, including if/then/else statements, and for/while loops. To what extent instructors make use of the programming capabilities of the calculators is unclear, but one suspects that it is not widespread. (One blogger had a TI Basic programming competition in which the judging was to be done by the blogger; this suggests that not a huge number of entries were expected. See `https://www.cemetech.net/index.php`. On the other hand there is plenty of online help for simple programming tasks, such as solving a quadratic equation, using the discriminant to determine the number and type of solutions, and then giving the numerical solutions. Search online for something like "how to program the quadratic formula on a TI-84" and there will be many results, some simple and some more complicated, some being You Tube videos showing how to do the coding, and some being downloadable programs that have already been created. It is possible that these resources could be used as the basis for a simple test of what students know about programming. Students in pre-transfer level courses generally need some instruction or at least access to instruction on using the calculator, and this will certainly extend to the programming aspects. So, if programming is to be incorporated, building on ideas that students may have had, some teaching will be necessary. Also, like any specific platform, the syntax and usage is to some extent specific to the TI calculators. TI calculators are well entrenched in our teaching program, so that the major textbooks and online homework programs would appear to assume that these graphing calculators will be used, and have embedded instructions for them. There are graphing calculator apps for smartphones and tablets, but it is likely that students will believe that buying a calculator is necessary.

From the TI calculator for classroom use the next step up is probably GeoGebra. Although there is a very active international GeoGebra community (see http://www.geogebra.org/cms/en/community-info and for California http://geogebraca.org/home/ but judging from our CMC[3] and even recent ANATYC conference proceedings, its use is not as widespread as it could be. One of the big advantages of GeoGebra is that it operates on many different platforms, and has a big support network. GeoGebra has its own scripting as well as Javascript. To see the kinds of things that can be done go to the first URL listed and choose materials. GeoGebra's programming environment includes turtles that can move about (slowly and not so slowly) making figures, and this feature may link what it does with some of the programming students have done previously. One of the big advantages of GeoGebra is that it is free. It is because we are looking to the future that it is included here.

To return from free to more common, one should also consider using Excel. Even if students do not have the official Microsoft version, the free versions work much the same. Using functions in Excel has its own kind of syntax having to do with the reference to cells in the spreadsheet, with special notation having to do with whether the reference to the cells are relative or absolute. The strength of Excel is that it is designed for business applications; that is also its greatest weakness for mathematics and statistics. Excel can be used to give some insight of the numerical behavior of functions, and can be programmed usefully to answer "what if" questions, a feature that is linked to its business application base. Graphing is possible, and those who are adept with Excel tend to see no problem with the graphs that Excel produces. However, compared with the graphs made in GeoGebra or any of the usual statistical packages, getting nice looking graphs for someone learning Excel can seem tedious and unpredictable. Compare the instructions for Excel written for middle school students (http://math.sduhsd.net/MathX/Excel/ExcelFunctionGraphing.pdf) with these instructions using GeoGebra (http://www.geogebra.org/b/P9fSOxh1#material/1201133). Included in the Excel function capability for spreadsheets are if/the/else statements, so that this part of students' experience may be used. It will take some serious thinking or searching to know how to use Excel effectively in the mathematics classroom, but the idea of learning some Excel expertise should be appealing to many pre-transfer class students.

Transfer non-Calculus Courses: Primarily Statistics

The most important of these courses at the present time is no doubt introductory statistics, and the discussion here will concentrate on that course. In the statistics education community, good practice these days is to encourage the experience of data analysis using statistical packages in all of statistics teaching. See these and other recommendations for statistics teaching outlined in the *Guidelines for Assessment and Instruction in Statistics Education* (Carver et al., 2016) at http://www.amstat.org/

education/gaise/collegeupdate/GAISE2016_DRAFT.pdf. With statistical packages, such as *StatCrunch* or *Fathom* or *JMP*, cleaning and filtering data and creating new variables for analysis are possible, and all of these packages use fairly simple but accessible coding skill. Fathom and JMP make if/then/else statements quite intuitive by using formatting that at least hints at what is happening. In both of these packages, the user is provided with a template, so that the tedious work of checking corresponding parentheses is avoided.

$\mathsf{If}(\ )\begin{cases}?\\?\end{cases}$ into which can be inserted something like: $\mathsf{If}(\mathsf{Price} < 20000\ )\begin{cases}\text{"Low"}\\\text{"Not Low"}\end{cases}$

(For these packages, see https://www.statcrunch.com/, http://fathom.concord.org/and http://www.jmp.com/en_us/academic.html) There is plenty to do in analyzing data that involves programming skills at a rudimentary level, principally involved in working with real data, and working with data (as opposed to pushing numbers through formulas) is one of the main thrusts of the recommendations for introductory statistics courses. Most of the statistical analysis packages being used have a graphical user interface rather than a command line platform, and this accommodates those students whose computer experience has been mostly with menus rather than writing code. Once again, we are back to the issue of what students actually know; many of the programming packages that younger children use still do not involve writing our code in the sense of having to check syntax in a serious way.

In the statistics education community there has also been a push to begin using the statistical programming language R in most teaching. There are some definite advantages of using R: the language is free to users and can be downloaded on students' own computers. The language is powerful and is used for higher level statistics courses. As an introduction to this push, see the little book by Kaplan et. al. ((Kaplan, Horton, and Pruim, 2013), as well as associated workshops by this group. The drawbacks to using R is that for the most part, R must be written in command language, and for many students there appears to be a steep learning curve: In a paper on using R in a applied statistics course for non-majors (presented at the 2015 International Conference on Technology in Collegiate Mathematics), Bell and Jagannathan (Bell and Jagannathan, 2015):55 remark:

> In a culture that relies heavily on technology, we expect our students to be fairly proficient. However, experience has shown that they often need more guidance than expected. Being "app" savvy does not always translate into general computer literacy.

The authors go on to offer advice on how to implement R, including instruction on how to download the language. In the paper, they have an *R Tutorial* (page 65 ff) that is quite detailed:

> This tutorial serves as a beginner's introduction to R. We walk through basic steps for reading in data, plotting, and obtaining descriptive statistics. BE VERY CAREFUL to type all commands presented here exactly as they

> appear. Small differences in syntax, spelling, or capitalization will cause errors!

Some of what students know and do not know about coding is implied by this preface: students will definitely have to learn to take care; but then translating a statement in pounds shillings and pence to be abel to calculate percentage profit also took care. Bell and Jagannathan are not writing to discourage the use of R, but they do point out clearly the difficulties involved. Their experience does seem to accord with what is picked up by listening to others who have introduced R in introductory courses (See (McNamera, 2015).

One can certainly argue that only a small proportion of the students taking Introductory Statistics will go on to a course where they should have the background to pick up R, and that therefore in the first course, the investment of time and effort on learning R is not efficient. Better would be to use an easier interface that uses some of what students may have picked up about the logic of programming, which can be directly used in the main business of the introductory course. This is a strong argument, but at the same time, teaching materials should be designed so that their use with R can be done. It may be that in the future there are courses and students in these courses who can cope with what at present appears to be a fairly steep learning curve for R.

Calculus Sequence

Very likely, students at this level will have had the strongest background with programming and coding, and one would think that there is more scope for interesting applications using something like Matlab. In some colleges, Matlab is already part of the engineering program, and so it may be a matter of coordination to determine at which point in the calculus sequence engineering students will have had exposure to Matlab. If matlab is used, then those enrolled in the calculus sequence who are not engineering students may be at a disadvantage, and there are colleges that do not have the license for the software. The answer to the second issue is that, at least for Matlab, there are free alternatives (specifically, Octave and FreeMat and Scilab; on these alternatives, see (Sharma and Goobert, 2010). The answer to the first question is probably to mount a half-unit open-entry (probably online) short course. Again, Bull has no recipes to offer, and certainly nothing like already packaged meals to offer, but at this level at least some culinary direction should not be difficult to find. As a good example, see the resources for John Thoo's 2015 CMC^3 Fall Conference talk, which can be found at `http://www.cmc3.org/conference/Monterey15/Monterey15.html`. (This is the link to all of the talks; scroll down to the one by John Thoo, and you will be taken to his page of talks and publications.)

4 Conclusions

The two problems to incorporating any kind of programming still stand. The first: we still do not know what students know about coding and programming, and the second: whatever we do will involve some teaching of syntax, etc. The only answer to the first objection is to try things and very quickly one will discover what gaps or otherwise there is in the students' background. On the second: whatever technology we use, whether graphing calculators or GUI based packages will inevitably involve some teaching. More than that, the teaching has to involve some assessment; with experienced students who can foresee the value of what they are learning for their future work, the assessment can be in that future work. For students who do not foresee that learning software and especially programming technicalities, and who hope that they can dodge any extra learning (letting other more tech savvy students carry the burden, for example) some kind of more immediate assessment will be necessary. So there will be some teaching of method; but there always has been, whether it has been how to use trig or statistical tables, or a slide rule, or a calculator.

One response to a draft of this paper asked the following questions about the experience of coding or programming:

- Will it help the students to be more logical with mathematics?
- Will the students be better critical thinkers in mathematics?
- Will the students be better mathematical problem solvers?
- How will the students' question "why do we have to learn coding?" be answered?

If others have similar questions from reading this, the purpose will of the paper will have been achieved. The take-away that Bull hopes for this piece is that we look for opportunities to use the experience that our future students will have in a productive way.

Ken Bull

References

Baker, C. C. T. (1956). *O Level Tests in Arithmetic*. Methuen.

Bell, L and K. Jagannathan (2015). "Introducing R in an Applied Statistics Course for Nonmajors". In: *27th International Conference on Technology in Collegiate Mathematics*. Las Vegas, NV.

Carver, R. et al. (2016). *Guidelines for Assessment and Instructionin Statistics Education (GAISE) College Report DRAFT February 2016*. Tech. rep. Available at `http://www.amstat.org/education/gaise/collegeupdate/GAISE2016_DRAFT.pdf`. American Statistical Association.

Kaplan, D. T., N. J. Horton, and R Pruim (2013). *Start Teaching with R*. Project Mosaic.

McNamera, A. A. (2015). "Bridging the Gap Bwetween Tools for Learning and for Doing Statistics". PhD thesis. University of California at Los Angeles.

Sharma, N and M. K. Goobert (2010). *A Comparative Evaluation of Matlab, Octave, Freemat and Scilab for Research and Teaching*. Tech. rep. Technical Report HPCF-2010-7, `www.umbc.edu/hpcf`. Department of Mathematics and Statistics, University of Maryland, Baltimore County.

Calendar

July 24-31, 2016 13th International Congress on Mathematical Education (ICME-13), Hamburg, Germany. Contact: Gabriele Kaiser, +49 40 42838 5320 x-5321, email: contact@icme13.org

September 24, 2016: LaMsMATYC Conference, Delgado Community College New Orleans, LA

September 24, 2016: WisMATYC Fall Conference, Univ of Wisconsin–Sheboygan, Sheboygan, WI. Website: www.wis.matyc.org

October 14-15, 2016: MichMATYC Annual Conference, Delta College, University Center, MI. Website: www.michmatyc.org

October 26-28, 2016 NCTM Western Regional Meeting, Phoenix, AZ. Contact: NCTM Office (703) 620-9840, email: regconf@nctm.org

November 4—5, CMC South Conference, Palm Springs Convention Center. Website: http://www.cmc-south.org/

November 17—20, AMATYC 42nd Conference, Denver, CO. Contact: Keven Dockter, e-mail: keven.dockter@anokaramsey.edu

December 2-4, 2016, CMC North Conference, Asilomar State Conference Center & Pacific Grove Middle School Pacific Grove, Monterey Peninsula, CA. Website: http://cmc-math.org/about-2/

December 9–10, 2016, CMC^3 44th Annual Conference, Hyatt Regency Monterey Hotel and Spa, Monterey, CA. Contact Katia Fuchs, City College of San Francsico, (510) 325-1616, efuchs@ccsf.edu

February 17-18, 2017: MAA-FTYCMA Joint Conferences, State College of Florida, Bradenton Campus. Website: http://sections.maa.org/florida/newsletter/callscfb.htm Contact: C. Altay Özgener

March 9—12, 2017, ICTCM 28th Conference, Chicago, Illinois, http://www.pearsoned.com/events-and-webinars/ictcm/

April 7-9, 2017: 50th Annual NYSMATYC Conference, Syracuse, NY. Contact: Phil Loud. Website: www.nysmatyc.org

April 21-22, 2017: 21st Annual Recreational Mathematics Conference, Lake Tahoe Community College. Contact Larry Green (530) 541-4660 ext. 341, drlarrygreen@gmail.com

Jay Lehmann
Editor
CMC^3 Newsletter
MathNerdJay@aol.com