California Mathematics Council Community Colleges

President's Report

Katia Fuchs, City College of San Francisco

We had a truly wonderful conference at Lake Tahoe Community College this April! It was our second year at LTCC and a true success! Please read the full report in this newsletter, but I do want to take a moment to acknowledge those who worked hard to pull this conference off. Holding the conference at a college means all of the logistics of putting everything together falls to the board – thank you, Larry Green and Mark Harbison, for the hours of work you put in to create a spectacular conference! Another huge task that falls to the board now is the preparation and serving of the food; everyone on the board pitched in to pull this off, and you have our deepest thanks. Special acknowledgement goes to Leslie Banta and Darryl Allen, who were our "food masterminds" and worked truly tirelessly to make sure there was plenty of delicious food to go around! We look forward to our next year at LTCC and very much hope you'll consider joining us there!

Speaking of our board, if you are interested in seeing what we are all about, our meetings are open to all! We are an organization run by volunteers who serve us all in the mission of advancing professional development for California community college mathematics instructors. Please consider joining us! If you want more information, contact me. Our next board meeting will be on September 8 at Solano College.

We in the world of community college mathematics education know that a lot of changes are brewing on the horizon. With the passage of AB705, a lot of our members are wondering how entering into compliance will affect their colleges and the way mathematics is taught. I want to assure you that CMC3 exists to facilitate civil discussion among our members, through the sharing of our experiences at our conferences and through our newsletter. We hope to continue to provide both information and opportunities for discussion at our December conference in Monterey. Please join us to share your thoughts! As always, please feel encouraged and welcome to submit a talk proposal for the

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President's Report

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Monterey Conference (see our website www.cmc3.org for speaker proposal instructions).

Finally, I would like to wish you all a successful summer! If you are teaching (like me), I hope you are able to get in a little rest between sessions. (I hope to do some traveling!) If you are not, I wish you glorious relaxing days, good books, and that you come back in the fall feeling renewed and rejuvenated!

Math and Quantitative Reasoning Task Force

Leslie Banta, Mendocino College

The ASCCC Math and Quantitative Reasoning Task Force (MQRTF) held its most recent meeting on May 30th to continue their work on providing math pathway options for community colleges looking for ways to best support their students in light of AB 705 requirements.

A report from the ASCCC spring plenary session was provided by co-chair, Ginni May. It was noted that there was nearly unanimous support from the field for the work that has been done so far by the task force.

On behalf of CMC^3, co-chair Leslie Banta provided an overview of the response received from her talk regarding AB 705 at the Tahoe conference. Attendees were glad to see that there is still support for a strong math curriculum. There was some concern expressed that CTE students may be negatively impacted as the focus seems to continue to build toward transfer even though that may not be the path some students are interested in taking. CMC^3's support of the task force's work was reiterated.

The task force was joined by guest, Myra Snell, of the California Acceleration Project (CAP). Ms. Snell, noting that her reputation precedes her, spoke of her early work in acceleration to statistics and her current focus on placement. The discussion included the varied interpretations of AB 705 and Ms. Snell's preference that STEM students be placed directly into precalculus. As many students in California have not taken a class above elementary algebra and pathways at community colleges are varied, there were concerns raised in this area. While Ms. Snell's approach to acceleration may not be the same as the pathway recommendations from the task force, the importance of collegial collaboration at all levels was agreed to by those in attendance.

The task force continues to make progress on creating course descriptors for accelerated courses in the statistics/liberal arts and STEM pathways as well as a bridge course designed to support students who wish to move from a statistics/liberal arts math pathway to a STEM pathway. The draft descriptors are being updated based on feedback from various stakeholders and, once complete, revised descriptors will be posted on the MQRTF web page at www.asccc.org/directory/math-and-quantitative-reasoning-task-force.

Future work for the task force will include research into creating more opportunities for students to consider STEM fields in light of the United States producing fewer STEM graduates, especially among students in groups who are underrepresented in the field.

Anyone is welcome to attend our board meetings. If you'd like to attend, please contact anyone on the board. We'll be happy to tell you the date and location of our next meeting.

Through the History Glass

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

If you are lucky enough to teach *epsilon-delta* proofs of limits and if you find that your students groan at the topic, just tell them, "Blame Cauchy!" or, perhaps better, "*Thank* Cauchy!"

Newton and Leibniz gave us the calculus in the mid-1600s—which offers its own exciting tale [4]—and for the next 150 years mathematicians happily and enthusiastically discovered many physical applications and mathematical results using it. But it was like the Wild West in the sense that mathematicians were not held back by any lack of mathematical rigor. As Grabiner [3, pp. 1–2] puts it:

> In the eighteenth century, analysts were engaged in exciting and fruitful discoveries about curves, infinite processes, and physical systems. The names we attach to important results in the calculus—Bernoulli's numbers, L'Hôpital's rule, Taylor's series, Euler's gamma function, the Lagrange remainder, the Laplace transform—attest to the mathematical discoveries of eighteenth-century analysts. Though not indifferent to rigor, these researchers spent most of their effort developing and applying powerful methods, some of which they could not justify, to solve problems; they did not emphasize the mathematical importance of the foundations of the calculus and did not really see foundations as an important area of mathematical endeavor.

The person whose name is best associated with the rigorization of the calculus is Augustin-Louis Cauchy (1789–1857).

Cauchy's father was a barrister. At 16 years old, Cauchy entered the Ecole Polytechnique in Paris, followed by the civil engineering school Ecole des Ponts et Chaussées, and then a position as a military engineer for Napoleon. During this time as an engineer, some leading French mathematicians took notice of Cauchy's mathematical abilities, so much so that Laplace and Lagrange persuaded Cauchy to leave engineering and to take up pure science and mathematics full time. Her later joined the faculty of the Ecole Polytechnique, rising to full professor in 1816, when he also won a grand prize from the French Académie des Science for his 300-page paper on the propagation of waves at the surface of a liquid. Cauchy was a staunch royalist who supported the Bourbon monarchy, and this caused him to go into a self-imposed exile for about two decades in Turin and Prague following the Revolution of 1830. He returned to France in 1838. (See, for example, [1], [5].)

According to Katz [5, p. 767], "Although Cauchy was the most prolific mathematician of the nineteenth century, he was never easy to deal with. As Abel wrote in a letter to a friend in 1826 during his visit to Paris, 'there is no way to get along with him, although he is at present the mathematician who knows best how mathematics ought to be treated.' "

Grabiner [3, p. 77] tells us, "Central to Cauchy's successful rigorization of the calculus was his simultaneous realization of two facts. First, that the eighteenth-century limit concept could be understood in terms of inequalities ('given an epsilon, to find an n or a delta'). Second, and more important, that once this had been done, all of the calculus could be based on limits.. . . " His definition of limit appears in his celebrated lecture notes, *Cours d'analyse* [2, p. 6], of 1821:

> We call a quantity *variable* if it can be considered as able to take on successively many different values.. . . On the other hand, a quantity is called *constant* . . . if it takes on a fixed and determined value. When the values successively attributed to a particular variable indefinitely approach a fixed value in such a way as to end up differing from it by as little as we wish, this fixed value is called the *limit* of all

the other values.

Cauchy treated limit, continuity, and convergence in *Cours d'analyse*, and the derivative and integral in his *Calcul infinitésimal* of 1823 [3, p. 78]. In a proof of a theorem on continuity, "Cauchy translated his definition of derivative into the language of delta-epsilon inequalities: 'Designate by δ and ε two very small numbers; the first being chosen in such a way that ... the ratio $f(x+i)-f(x)/i$ always remains greater than $f'(x)-\varepsilon$ and less than $f'(x)+\varepsilon$.' ... [This was] the first appearance in history, incidentally, of the delta-epsilon notation..." [3, p. 115]. Grabiner [3, p. 76] remarks that the Greek small letter ε "probably comes from the correspondence between '*epsilon*' and the initial letter of the French word *erreur*."

If you are looking for something worthwhile to read this summer, pick up Judith Grabiner's *The Origins of Cauchy's Rigorous Calculus* [3]. You will not be disappointed—guaranteed ... well, $\pm\varepsilon$.

◇

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] David M. Burton, *The History of Mathematics: An Introduction*, 7th ed., McGraw-Hill, New York (2011).

[2] Augustin-Louis Cauchy, *Cauchy's Cours d'analyse: An Annotated Translation*, translated and annotated by Robert E. Bradley and C. Edward Sandifer, Springer, New York (2009).

[3] Judith V. Grabiner, *The Origins of Cauchy's Rigorous Calculus*, Dover Publications, Inc., Mineola (1981).

[4] A. Rupert Hall, *Philosophers at War: The Quarrel between Newton and Leibniz*, Cambridge University Press, Cambridge (1980).

[5] Victor J. Katz, *A History of Mathematics: An Introduction*, 3rd ed., Addison-Wesley, Boston (2009).

Math Nerd Musings: Gratitude for John Thoo

Jay Lehmann, Newsletter Editor, College of San Mateo

After having written the *Through the History Glass* column for over 10 years (the column started in the fall issue, 2006), John Thoo has submitted his last article this issue. That's over 30 articles on a wide range of mathematical concepts and mathematicians!

Once an editor of the newsletter, John surprised me by offering to write the column; usually I have to bend an arm or two to persuade someone to contribute. I also appreciate that he never failed to submit his column and he always did so early—something an editor greatly cherishes in a columnist!

But what I'm most grateful for is that John widened my vision of the newsletter.

But what I'm most grateful for is that John widened my vision of the newsletter. Yes, we need articles about past and upcoming conferences, board developments, and the foundation. But he has provided us with a resource for what we value most: Mathematics. Thank you, John, for all your hard work!

Although I never would've thought of including a history column in the newsletter, I do recognize a fantastic idea. So, I'm happy to say that I've invited our Past President, Joe Conrad, to continue writing the history column (perhaps under a different title) and he has agreed! If you've ever been to one of Joe's talks, you know we're in for a great ride!

Mathematical Adventures in India

Dean Gooch, Santa Rosa Junior College

While at the Science Centre in New Delhi India, I found the mathematics section and began looking at the displays. I was pleased to see the wonderful discoveries of several early Indian scientists and mathematicians displayed. There were elaborate water clocks and sundials as well as centuries-old celestial observatories.

One of the displays had a right triangle with a square along each side. The hypotenuse square had a bright liquid in it which when rotated, bled completely into the squares associated with the legs of the right triangle.

There was much written about the display, mostly in Hindi. There were translations in English as well. One was of particular interest to me. It read:

"'In right-angled triangles the square on the side subtending the right angle is equal to the squares on the sides containing the right angles.'-Wrote Euclid around 300 B.C. The theorem is attributed to Pythagoras. (6th century B.C.) by Greek writers of the first four centuries after Christ but historians pointed out that the Greek literature of the first five centuries after Pythagoras contained no mention of this discovery by the great philosopher."

"Turn the disc and notice that the liquid in the largest square just fills up the two smaller squares thus proving what is called the Pythagorean or Sulba-Sutra theorem."

This reference to the Indian Sutras is prevalent in early Indian mathematics history. The Sulba Sutras were Sutras or writings that were composed from 800 BCE to 200 CE. They are usually in Vedic Sanskrit, written in verse and were part of the Vedas or religious writings of that period.

The Sulba Sutras contain many mathematical formulas, concepts and problems. In fact, the "Tower of Hanoi" problem that was believed to have been first discovered by the nineteenth century French mathematician Édouard Lucas was touted as the "Tower of Brahma" from an ancient Indian tradition in a nearby display to the right triangle one.

These Sulba Sutras are some of the earliest mathematical writings known. Many of the early works are better known through the writing of later commentators. In many cases, copies of the original writings were rewritten in the works of the commentators. The great early Indian 500th CE century mathematician, Brahmagupta, wrote the famous Brāhmasphutasiddhānta, which is known primarily from the commentaries of the Bhāskara I that were made in the 600s CE.

These ancient writings are kept in document libraries throughout the Indian region. I visited one of these libraries on the

West Bank of the river Sabarmati in Ahmedabad in the Gujarat State of India.

This library has documents that were as old as fifteen hundred years. Each "book" that was shown to me was a series of stacked pages on heavy paper that was wrapped in a protective cloth tied with a strip of cloth that held everything together. My host brought out several of these works to show me how they looked and were kept.

Each leaf or page was hand written. Sometimes the script was organized in appealing artistic patterns. The pages were about four inches wide and ten inches long. Although, the librarians were not able to come up with any mathematical writings for me to look at, I did get to see several astrological writings that included tables and numbers. In some cases, the writings were in some form of Sanskrit, Hindi or the local Gujarati language.

Eventually, the Head Librarian who is a professor and mentors several graduate students, brought out writings that were written in Arabic script. I asked if the writings were in Arabic, Farsi, some sort of Urdu or a transliteration of Sanskrit or Gujarati. He told me that these tended to be a mixture of the languages that I mentioned and others. He said that the ones that use Arabic script are his specialty.

His graduate students are actively translating as much as they can into modern languages and yet his and other students can only scratch the surface of the wonderful writings that can be found in these document libraries. There is so much that remains in libraries that have been yet undiscovered and untranslated including many unknown mathematical writings.

Our conversation ended with my signing of the visitors' book and a required written explanation of how and whether my visit to this document library was useful to me. I assume that this was for the purposes of justifying government support for this facility.

A picture of the Director of the library was taken with me. He said that I looked like a traveling Sage and wanted to add this photo to his collection.

These documents' libraries can be found throughout the Indian region and have somehow survived India's crazy and violent history without much destruction. Scholars from throughout the world visit these document libraries and regularly make new

discoveries.

Later in my trip at a Indian mathematics history conference in nearby Gandhinagar, I heard a talk given by a Sanskrit scholar from New Zealand who specializes in mathematical tables. She was marveling over one of her recent discoveries of ancient, I believe about 500 CE, very accurate trigonometric tables. These were some of the earliest and most accurate trigonometric tables ever discovered.

As for whether the so-called Pythagorean theorem was discovered by Pythagoras, the Pythagoreans, other Greeks, Indians, Persians or Extraterrestrials, here is what I think:

Since the ancient Cuneiform writings of the Babylonians include Pythagorean triples, one could speculate that the Pythagorean theorem may have originated there. More likely, the origin of this concept started with the geometry necessary for surveying, construction projects and the tracking of celestial bodies. The Pythagorean theorem or Sulba-Sutra theorem may have been discovered and rediscovered many times. It is really not important to think that there was a single source of discovery for this theorem. This just gives more evidence that most concepts in mathematics are not named for the original discoverers of that concept.

Pi Day Contest: March 14, 2018

Judith Howe, Librarian at Sacramento City College

Pi Day was once again a lot of fun and, I think, a great success!

We started the event with Professor Caviness reading a poem about Pi called "Somewhen." Then, each contestant

wrote as many digits of Pi as they could remember on a white board in a classroom, while the other contestants waited in the hallway. All the contestants were careful and took their time.

Two hours later, we had a winner. All the contestants did a fantastic job, but Vu Do triumphed with a total of 253 digits of pi. If he had not made a mistake, he would easily have doubled that number.

(see "Pi Day" on p. 13)

The Pleasures of Problems

Kevin Olwell, San Joaquin Delta

Summer 2018: How many solutions does the following equation have:

$$\frac{1}{5}\log_2 x = \sin(5\pi x)$$

Spring 2018: If $g(x)$ is a non-negative, real-valued function defined on the real line, then every solution of the following ODE is bounded :

$$y + y'' = -x\, g(x)y'.$$

It seems that few readers of this column are as charmed by physics and physical thinking as I am. An idea leading to the solution comes from first semester physics. Newton's second law leads to the equation $F = ma$. It turns out that many forces in physics are a function of the object's position; such forces are called conservative by physicists.

$$my'' = F = h(y)\,.$$

For example, if the force comes from a stretched spring, then $h(y) = -ky$. This leads to an equation similar to ours when $g(x)$ is identically zero. The trick is to multiply by y'. Now each side of the equation $F = ma$ is a derivative with respect to time. In physics a well chosen anti-derivative for h is called the potential energy, written U; the anti-derivative for $my'y''$ is called the kinetic energy, K. The total energy, $E = K + U$, is constant for conservative forces. In our equation multiplying by y' is still a fruitful idea even though the "energy" will not be constant, Having suggested how a solution might have been discovered, we follow Gauss' practice of hiding the motivational scaffolding and presenting a solution that seems to have come out of thin air.

Consider $F(x) = y(x)^2 + y'(x)^2$. The ODE gives the following expression for the derivative of $F(x)$:

$$\begin{aligned} F'(x) &= 2y'(y + y'') \\ &= -2xg(x)y'(x)^2. \end{aligned}$$

Since $g(x) \geq 0$, we see that $F'(x) \leq 0$ whenever $x > 0$. Similarly $F'(x) \geq 0$ when $x < 0$. Thus $F(0)$ is a global maximum for $F(x)$. Hence

$$\begin{aligned} & y(x)^2 \leq F(x) \leq F(0) \\ \Rightarrow \quad & |y(x)| \leq \sqrt{F(0)}. \end{aligned}$$

All are invited to submit a solution to the Summer 2018 problem either via email or US mail at the address below.

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The 22nd Annual CMC^3 Recreational Math Conference in Lake Tahoe

Larry Green, Lake Tahoe Community College

In April, we got to enjoy another wonderful conference. The 22nd annual recreational math conference in Lake Tahoe was our second Tahoe conference that was not held inside a casino but instead took place at Lake Tahoe Community College.

The conference began with a foundation get-together where we reconnected with our colleagues from California and other states. We partook of plenty of food and drinks while at the same time contributed towards the foundation scholarships by purchasing raffle tickets to help out our students. This get-together was followed by keynote speaker Carlo Sèquin, who entertained us with three dimensional artistic models that helped us understand 3D and higher dimensional topology. We also got to see famous art that utilizes mathematical topology.

On Saturday morning, we had the difficult decision to select from many talks that included outstanding presentations on games, conics, circles, and challenging problems. The morning talks were followed by a delicious lunch that was prepared by our own CMC^3 board members. I want to especially thank them for putting together a conference full of yummy eats. After lunch, the weather treated us well so we then went outside in search of hidden geocache items whose GPS coordinates could only be found by solving challenging mathematics questions. One of the caches was hidden in some leftover snow. Next came our Saturday keynote speaker, Janko Gravner, who presented on how everything is ordered or disordered.

After the keynote presentation we were once again entertained by math lectures that involved math contest questions, artificial intelligence, and a discussion on AB 705. The grand finale of the conference was our student speaker, Christopher Yang, from Las Positas College who showed us how mathematics can

predict the future orbit of the moon. Sadly, the moon's orbit is getting farther and farther away from us and eventually will say goodbye.

We had an amazing turnout this year, and we plan on hosting the 23rd annual Tahoe Recreational Math Conference again at Lake Tahoe Community College on April 26 and April 27, 2019. Look for more information about it in future newsletters.

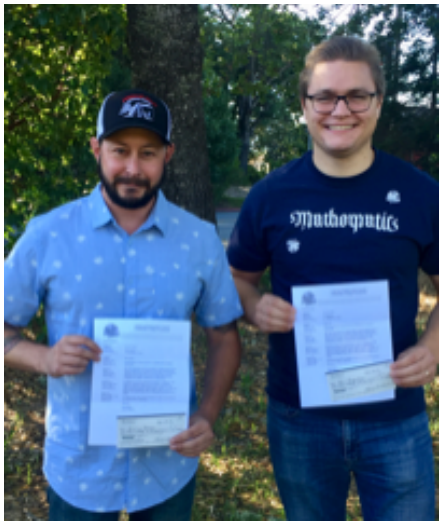
Please consider putting one or two newsletters in the copy room for other instructors to read.

CMC^3 Foundation Report

James Sullivan, Foundation President, Sierra College

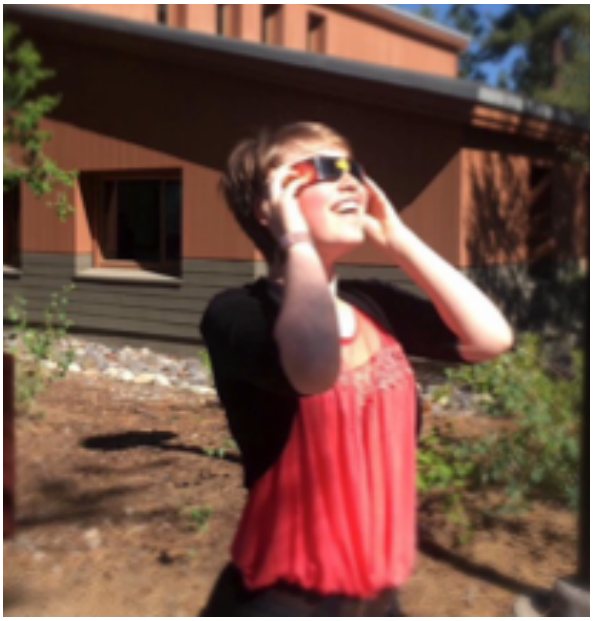
The CMC^3 Foundation hosted a welcome reception to open the 22nd Annual Recreational Mathematics Conference. Attendees got to sample an assortment of drinks, fruits, vegetables, rolls, meatballs, cheese and crackers as they socialized and awaited the Friday evening keynote presentation. The welcome reception concluded with the announcement of the 2018 CMC3 Foundation Mathematics Scholarship recipients. The following six outstanding California Community College students were awarded a $1000 Scholarship from the CMC3 Foundation.

Jeremy Ronco works full time as a Civil Engineering Technician while maintaining a 4.0 GPA as a returning student at Mendocino College. His educational goal is to become a fully licensed civil engineer. Jeremy is a member of the MESA club, and he leads the Physics for Scientists and Engineers workshop. Jeremy also assists professors at Mendocino College with a special project that tracks and predicts the trajectories of meteorites.



Levi Baguley will transfer to Brigham Young University at Idaho where he will major in applied mathematics. He has a 4.0 GPA at Mendocino College. Levi serves as vice-president of the MESA program and worked as a facilitator during their Academic Excellence Workshops. He is a member of Phi Theta Kappa and a Dwight D. Eisenhower Transportation Fellow.

Hannah Brown plans to transfer to UC Davis to pursue a bachelors degree in computer science with a minor in linguistics. Her career goal is to work in the field of computational linguistics and develop systems that allow computers to understand human language. Hannah is the president of the Science club, vice-president of the Math club, and serves on the Student Senate at Lake Tahoe Community College while maintaining a 4.0 GPA.



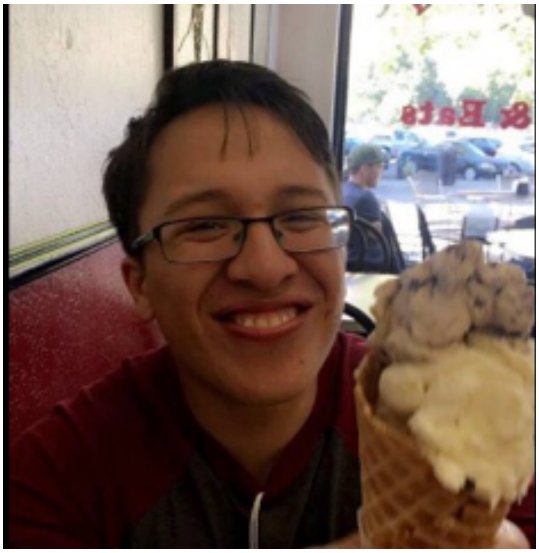
Laura Johnson plans to transfer to UC Berkeley as an applied mathematics major. She has a 4.0 GPA and is a member of the Las Positas

College Math Society and the Mu Alpha Theta Honor Society. Laura participated in the AMATYC Student Math League and won one of the top scorer awards. Laura works as a tutor and is determined to pursue a graduate degree in Mathematics.

Samira Sebt has a 4.0 GPA at West Valley College. She plans on

transferring to UC Davis in bioengineering. Samira works as a tutor for the West Valley College TRiO program. She received an internship working for a start-up technology company helping them develop a device to detect distracted driving.

Andres Franco Valiente is one of the top students in mathematics and science at Ohlone College. He plans on transferring to UC Berkeley as a chemical engineering and mathematical physics major. Andres is the president of the Beta Tau Mu Honors Club at Ohlone College. He worked as a tutor in the



Ohlone College Math Learning Center.

The CMC^3 Foundation also oversees the Tahoe Conference Student Speaker Award Contest. The student selected to receive this award has the honor of making the closing presentation at the Spring Recreational Mathematics Conference and receives a $500 Scholarship.

This scholarship is supported via an annual donation made by Debra Landre, a retired San Joaquin Delta College faculty member and former CMC^3 President. This year's Tahoe Conference Student Speaker Award winner was Christopher Yang from

Las Positas College. Christopher's presentation on "Tidal Forces and the Expanding Orbit of the Moon" was one of the highlights of this year's conference. His presentation was very educational, interactive, and enhanced through the use of 3D animations. The CMC^3 Foundation would like to express our appreciation and gratitude to Christopher and his faculty mentors, Dr. Ruchira Majumdar and Dr. Robin Rehagen, for providing us with such an outstanding presentation.

Jeremy, Levi, Hannah, Laura, Samira, Andres, and Christopher are prime examples of the types of extraordinary students who study and learn mathematics in the California Community College system. If the CMC^3 Foundation were to receive more donations to its Annual Scholarship Fund, we could recognize and reward additional worthy and deserving students. So, please consider supporting our scholarship fund by making a tax deductible cash donation either by credit card or PayPal using the "Donate" button on the CMC^3 Foundation webpage http://www.cmc3.org/foundation.html or by mailing a check to Leslie Banta, CMC^3 Treasurer, Mendocino Community College, 1000 Hensley Creek Rd, Ukiah, CA 95482.

Mark Your Calendar:
46th Annual CMC^3 Conference
December 7th and 8th, 2018
Hyatt Regency Monterey Hotel and Spa

Pi Day

(continued from p. 8)

Here are the results:

1st place: Vu Do – 253 digits (won $50 and an apple pie)
2nd place: Marcelo Alarcon – 250 digits (won $35)
3rd place: Raynaldo Tellez – 227 digits (won $15)
Corbin West – 114 digits
Thalia Orozco – 103 digits
Victoria Cox – 98 digits
Ahzariah Lee – 96 digits
Ivan Pang – 56 digits
Carolina Ramirez – 33 digits
Tanner Eckmann – 24 digits

All contestants received a pi pencil.

Calendar

September 21, 2018: InMATYC Fall Conference, Ivy Tech Community College Indianapolis (Fall Creek) Contact: Luanne Benson-Lender Website: http://inmatyc.matyc.org/

September 29, 2018: 25th Annual WisMATYC Conference, UW Washington County, West Bend WI. Contact: Turi Suski Website: wis.matyc.org

October 5, 2018: ArizMATYC Meeting, GateWay Community College, Phoenix, AZ. Contact: Shannon Ruth Website: http://arizmatyc.org/

October 5 - 6, 2018: NDMATYC Fall Conference, Chieftain Conference Center, Carrington, ND. Contact: Michael Kern, michael.kern@bismarckstate.edu

October 12 - 13, 2018: 2018 MichMATYC Conference, Kalamazoo Valley Community College Contact: Kelly Digby Website:

https://sites.google.com/view/michmatyc2018/home

November 2—3, 2018: California Mathematics Council—South 59th Annual Mathematics Conference, Palm Springs. Website: http://www.cmc-south.org/conference.html

November 15–18, 2018: AMATYC Conference, Orlando, FL. Website: https://amatyc.site-ym.com/?2018ConfHome.

November 30—December 2, 2018: CMC North 61st Annual Conference, Student Voice: Let's Hear It!, Pacific Grove, CA. Website: http://cmc-math.org/cmc-north/

December 7–8, 2018: CMC^3 45th Annual Conference, Hyatt Regency Monterey Hotel and Spa, Monterey, CA. Contact Jen Carlin-Goldberg, Santa Rosa Junior College (707) 527-4746, jcarlingoldberg@santarosa.edu

April 26-27, 2019: CMC^3 23rd Annual Recreational Mathematics Conference, Lake Tahoe CC, South Lake Tahoe, CA. Contact: Mark Harbison (916) 558-2687, mark.harbison@losrios.edu

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