NevMATYC Newsletter

Volume 1 Issue 1 Spring 2017

A Note from the President

NevMATYC is up and running. We have been a bit quiet for the last few years, so we have a lot of catching up to do.

First, we have a new Board.

Denny Burzynski, CSN: President
Dan Hooper, TMCC: Northern VP
Lisa Savy, CSN: Southern VP
Jonathon Lam, TMCC: Treasurer
Hieu Do, TMCC: Secretary
Lisa Brady, CSN: Newsletter Editor
Jen Gorman, CSN: Past-President
Eric Hutchinson, CSN: Second Past-President
Jim Matovina, CSN: Third Past-President

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In This Issue

College of Southern Nevada News

The Math Department at CSN has had a busy year. After an extensive search, we are so excited to welcome four new tenure-track faculty members this fall. Our department will be growing to 41 full-time faculty and about 60 adjuncts.

At our college's Tech Expo, the math department staffed a table for attendees to come by and chat with us. Eric Hutchinson constructed a parabola display, where we were able to use a laser to show that the beam reflected off the curve of a parabola always goes through the focus. We also had a quincunx board to demonstrate probability and the normal distribution.

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Would you like to include an article in a future issue of the NevMATYC Newsletter?

We would love to hear your ideas and thoughts about teaching mathematics and any news about your mathematics department. Types of articles are not limited to ones you see in this issue—we are always looking for new ideas and would love to hear your take. Whether you would like a recurring article or a one-time piece, please send information or questions about the newsletter to our newsletter editor, Lisa Brady, at lisa.brady@csn.edu.

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About the Board

Denny Burzynski, President

Department of Mathematics, CSN from 2011-present

West Valley College, Silicon Valley, California, 1980-2009

President, California Mathematics Council of Community Colleges (CMC^3), 1990-1991

AMATYC Newsletter Editor circa 1985. I would type the newsletter on my Mac, save it on a floppy disk, then take the disk to a printer and had several thousand copies printed. I would then take the copies to the Board, who would send them out to all the AMATYC members. At this time, there was only one font on my computer.

My current interest is in creating a new course for non-STEM majors that would introduce students to the common functions mathematicians use to describe the relationships we see in the world outside the classroom. I am thinking it would be a course that takes the place of 95, 96, and 124. We'll see where it goes.

Some of the books I have read recently and have found most interesting are *Genius at Play, the Curious Mind of John Horton Conway*, by Sioban Roberts; *Burn Math Class*, by Jason Wilkes; *The Math Myth*, by Andrew Hacker; and *Sapiens*, by Yuval Noah Harari.

Dan Hooper, Northern VP

Department of Mathematics, TMCC from 2016-present

University of Utah, 2013-2016 (Graduate instructor)

Washington State University, 2011-2013 (Graduate instructor)

MS, Mathematics (math-biology focus), University of Utah, 2016

MS, Mathematics, Washington State University, 2013

Recently, I have been experimenting with teaching using a Wacom tablet and a projector. I have found that my students enjoy the notes being posted online immediately after class, and it allows me to incorporate other technologies into my lectures (such as graph animations and calculator demonstrations).

My interests include skiing, playing ukulele and harmonica, backpacking, reading, and traveling. I am new to Nevada, and I have found it a great place to live so far.

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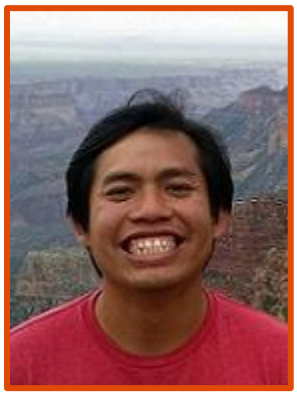
Lisa Savy, Southern VP

Lisa is thrilled to have just earned tenure at the College of Southern Nevada. Previously, she worked for Nevada State College, Western H.S. (CCSD), and several high schools in Southern California for a cumulative total of over 25 years of teaching. At CSN, Lisa has chaired the MATH 104 textbook committee, participated in the MATH 96 final exam committee, coordinated and proctored the AMATYC Student Math League, and produced a series of Math Placement Test informative videos. She has also presented at the CMC3S conference, the AMATYC conference, as well as attended AMATYC for four years. She is excited to serve as one of the new VPs of NevMATYC and hopes other members will feel free to contact her about any issues in mathematics education.

In her spare time, Lisa enjoys screenwriting and producing independent films. Her short film "The Principal's Bad Day" will be screening at the Las Vegas Black Film Festival in April 2017, and the film she wrote and associate produced, "Dreams I Never Had" featuring Malcolm McDowell and Robin Givens, will be released in 2017.



Hieu Do, Secretary

Department of Mathematics, TMCC from 2016-present

Born and raised in Vietnam; bilingual. I have been learning Spanish, French, German and Japanese, none of which I can confidently speak fluently. I am curious as to what kind of accent I might have.

I was a serious mathlete back in the day. During the exhilarating summer of my sophomore year at Le Hong Phong high school for the gifted, I had nine different math teachers teaching different math subjects. My first paychecks were from math contests. Now, I volunteer for the Northern Nevada Math Club contests and help prepare students for the American Regions Mathematics League.

I am interested in finding new explicit linear automorphisms on tori of genus ≥ 3 that has vanishing Sah-Arnoux-Fathi invariant. I run searches for special closed cycles on directed graph using Maple. I have better odds at winning a lottery ticket.

Jonathon Lam, Treasurer

Department of Mathematics, TMCC from 2016-present

I am living my dream of moving out west, climbing as much as I can on the best granite I can find. Currently, I am learning to play ukulele, hoping that one day I can play music on a portalege halfway up some alpine big walls.

I am reading a biography on Henri Poincare by Jeremy Gray. It gives a very good narrative on the development of a few branches of mathematics that Poincare worked on. Highly recommended if you want some light reading.

Lisa Brady, Newsletter Editor

Department of Mathematics, CSN from 2016-present

I am a transplant from Ohio. I miss the green, but not the cold, so I am fine with the trade.

I am currently reading *Teach Students How to Learn*, by Saundra McGuire. She was a keynote speaker at a conference I recently attended, and she had some great advice about student study skills. I am looking forward to passing along any insight I gain.

I have more fonts than I could possibly need for a newsletter.

Jim Matovina, Webmaster

Department of Mathematics, CSN from 1996-present

Former Math Department Chair, current Webmaster

Two terms as NevMATYC President, long-time NevMATYC Treasurer

Local Events Coordinator for the 2009 AMATYC Conference in Las Vegas

Co-Author of *When Are We Ever Going To Use This Stuff?* textbook. Published by Cognella Academic Publishing, and used in many of CSN's MATH 120 classes

Co-Author of *Applied Mathematics* textbook. Self-published, and used in all of CSN's MATH 104B classes

College of Southern Nevada News (continued)

We have recently brought back our Math Club. We are excited to see how this group grows and encourages involvement in our math courses. The students are being led by faculty advisor Amin KM.

A School of Science and Mathematics committee has recently formed to look into undergraduate research programs for STEM students. Jennifer Gorman and Lois Summers are on the committee representing our mathematics department.

Earlier this semester, we held elections for our Department Chair. The department selected Patrick Villa to continue on as Chair for another three year term. We are looking forward to continuing the trend of getting together more outside of department meetings. Our holiday party in December proved to be a great night of socializing, and we are looking forward to having another post-semester get-together this May.

Flipping the Classroom

Submitted by Gail Ferrell, TMCC

If you have had interest in flipping a classroom, I have a link to a video on my website. When we get our NevMATYC webpage going, it could be posted there.

The need for change in the mathematics curriculum at the high education level was articulated at the National Council for Teachers of Mathematics annual conference in San Francisco in April 2016. These recommendations are described in the new Mathematical Association of America's publication: A Common Vision for Undergraduate Mathematical Sciences Programs in 2025 by Karen Saxe and Linda Braddy.

Additionally, our Nevada State Math Task Force for Higher Education published the recommendations for state-wide changes in mathematics for NSHE. A brief summary of the considerations and recommendations are:

- We must teach more depth in mathematics, not more bredth.
- We need to offer "multiple pathways" which translate to teaching statistics and mathematics embedded in other STEM areas.
- We need to emphasize modeling, statistics, and discrete mathematics.
- We need to increase conceptual understanding of mathematics and the application of mathematics across disciplines.
- There currently is a national appetite for curricular changes in mathematics at the higher education level in the US, and now is the time to seize the opportunity.

Math Contest…Coming Soon

Calling all faculty and students! Starting in the fall, our newsletter will feature a challenge problem section. Each challenge will include a student problem. There will be prizes. Submissions will be available to be turned in via email. Pass it on to your students to join in the fun!

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A Note from the President

Second, we are creating a website for our organization. Jim Matovina, of CSN, has volunteered his services and is, this spring semester, assembling a prototype site. A question to each of us is "What would you like to see as recurring features on our website?" If you have some ideas, please pass them on to one of our Board members. Perhaps we could include on the site the names and email addresses of our Board members, links to all the Nevada community colleges and 4-year colleges, links to AMATYC affiliates, and a resource page where we can put our mission statement and our By-Laws and Constitution.

Third, let's talk about annual conferences. Apparently, we have had conferences in the long-ago past, but none in the recent past. I have heard that our last conferences were held in Tonopah. Apparently, those were not well attended enough to continue with them. Since we are all so far apart from each other, holding annual conferences is probably not something we can do. That really is too bad. Conferences offer us time together, time that we can use to talk about what is going on at our colleges, what our departments are doing, what each of us as educators and mathematicians are thinking about, and just time to get to know each other. However, since we are a pretty technologically savvy group, we could have a virtual conference. We could invite faulty to post PowerPoint for visitors to the webpage to view. It's not as good as watching a presentation live, but it is, at least, a way of communicating to each other what we are doing, what we are thinking, and what we find interesting. Perhaps, too, we could encourage a student to create a PowerPoint presentation on something he or she is curious about.

Fourth, our new NevMATYC newsletter. Lisa Brady, of CSN, is our newsletter editor. She is, this spring semester, putting together a template for our newsletter. The newsletter is a new adventure for us so we are looking for ideas. Got some? Send them to Lisa for her to noodle on. Got something you want to share about your department, your college? Send us photos. Is your college hiring? Did you read a book you think many of us would enjoy? Did you hear a good math joke? Share it with us. Let us know, and we will try to get it into the newsletter. Maybe there is a cartoonist among us. Are you interested in writing an ongoing column for the newsletter? We may be interested.

Fifth is our Mission Statement, By-Laws, and Constitution. The Board would like to look at these documents carefully and update them. I have a copy but do not see a date noted on them. Once we get the website up, we will post them for you to see. The Board will make suggested changes, then we will ask for a vote to accept them or not.

Last, let's put together a history of NevMATYC. I came from California to CSN in 2011. I don't know the history of NevMATYC. I do know the past three presidents, Jen Gorman, Eric Hutchinson, and Jim Matovina, because they are all here at CSN with me, and we have talked about NevMATYC. Do you have information that can add to our history? Were you here at the beginning of NevMATYC or know someone who was? If you do, please send that information to our secretary, Hieu Do, at TMCC. We will do what we can to construct a chronological history of our organization.

QED

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The Community College Algebra Curriculum and a Case for Change

Submitted by Denny Burzynski, CSN

If I may, I thought I would share some of my thoughts about community college algebra courses. The outcome of these thoughts is that I think we should develop a new algebra track for non-STEM students. One course that covers MATH 96, 96, and 124.

We are now well into the spring semester, and I am really struggling with the material in my MATH 124 course. I am wondering if anyone else might be having a time of it with your algebra courses.

As I came out of class Thursday afternoon and walked back to my office, I felt like a crafty salesman—a guy who was trying to sell 35 people something they don't need, don't want, something totally irrelevant to them, and something they will never use. I had just spent the last hour and 20 minutes demonstrating how to solve 3x3 systems using Gaussian elimination. I did a fine job of it and was able to connect with and frustrate everyone in the room. Then, I thought, *next week I have to do it all again*.

MATH 124 is an algebra course taken primarily by students in non-STEM programs. When I go into that 124 class, I feel like I am burdening already overworked students with material that is useless to them and that is actually an obstruction to their dreams and their college success.

I have been thinking about this question for several years now. It seems to me that we are (way)^2 off the mark on the curriculum we present and require in our algebra courses. (By "we," I mean the universal "we" of all college mathematics departments.) I can see no reason at all for a college to require non-STEM students to take a pass an algebra course (at least as they are currently structured). From all I have read, about 85% of U.S. students are in non-STEM programs. Do we really feel that it is okay to keep a journalism major from getting a college degree and maybe a job at a newspaper, or a music major from getting a degree and going on to a music career because he or she cannot solve an equation involving a square root or factor some trinomial? Are we willing to say that people who cannot demonstrate the procedural skills of MATH 95, 96, or 124 should not get a college degree? What materials, skills, or procedures in these courses are so important that all college students, regardless of their major, need to know?

I have heard it said that the reasoning skills learned in mathematics courses can be transferred to other areas. But, there seems to be no evidence to back up this claim. In fact, the mathematician Morris Kline of NYU wrote *There is some question about whether the training to think in one sphere carries over to thinking in another. One may be inclined to believe that it does, but one could not prove that it is so*. Peter Johnson of the Eastern Connecticut University states that *There appears to be no research whatever that would indicate that the kind of reasoning skills a student is expected to gain from learning algebra would transfer to other domains of thinking or problem solving or critical thinking in general*. I believe these guys and am not buying into the argument that taking an algebra course (as they are currently constructed) helps to develop general critical thinking skills. I used to think so, but I don't think so now.

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Mathematics departments have been teaching this same algebra curriculum in high schools and colleges for 70+ years with little thought of its appropriateness to our current audience. This curriculum was originally developed after WWII to get people into calculus and engineering to build the country. We now have an entirely different audience, yet we are presenting the same old material.

For sure, mathematics is one of humankind's great achievements and part of the college experience is to be introduced to those achievements. Our current algebra courses are most surely not making that introduction. How does the material in a 95, 96, or 124 textbook illustrate to a non-STEM student how mathematics has shaped our civilization? Surely, too, to be good citizens, Americans should have a good, basic knowledge of science and mathematics, which is, as we all know, the language of science. But the way our algebra courses are structured now, non-STEM students are not understanding that language and therefore, may not be getting that basic understanding of science we are here to give them.

People come to our colleges with dreams of getting a college degree and an education that will better their lives. My college, CSN, is a member of the Achieving the Dream community and on the first page of the ATD website is written

> *We are a catalyst for providing ways for colleges to strengthen and build their capacity to ensure that more students complete their college education and have more opportunity for economic success.*

I am thinking now that it is mathematics departments that are keeping talented non-STEM people from achieving their dreams and getting degrees/certificates. We are requiring the great majority of the people who come to us, hoping for a better life, to learn material and perform operations they will never need. We are forcing our students to master computational skills and carry out mechanical procedures when we could be proving them with a deep understanding of how mathematics is used, how to use it, and what it does for us. Talented people who could make meaningful contributions to society come to us and, because they cannot simplify a radical, complete the square, or simplify 8^(-2/3), we deny them a degree, send them away, and never experience the benefit of their talents. Could it be that we are the ones who, for no good reason that I can see, are getting in the way of college completion and student success?

We, as educators and keepers of the gate to dreams, are obligated to change this curriculum so that it truly reflects the needs of our students. I think we need to develop a new (really new) mathematics course for non-STEM college students, one that shows how mathematics has influenced the World's cultures, its political systems, and its philosophies. The curriculum we have now is failing us. (Just look at our pass rates and how many students dislike mathematics.) I do not think that students coming out of algebra courses really have any understanding of what they just did and why they were required to do it. Our books are mostly "if you see this, do this" books. Currently structured algebra courses are mechanics courses—pretty useless for non-STEM students. We have a wonderful discipline, but who would know that coming out of an algebra course? We need a new course that shows students what mathematics does, how it does it, and how it so wonderfully describes the world around us. And a course that does so using 21st century technology, not 15th century pencil technology. I cannot find one that exists, but I have some ideas.

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How about creating two sequences—a standard algebra sequence for STEM majors and a mathematics course for non-STEM majors? (I do not mean here a MATH 120-type course.) The non-STEM course would cover all of the material in the 95, 96, and 124 courses, but do so using technology. It could give a big picture of how mathematics is used. The course could examine many of the models mathematicians have developed to describe relationships and extract information about them. Using technology, I think we could introduce and show how to use polynomial models, rational models, exponential and logarithmic models, as well as trigonometric models. We could even introduce and demonstrate how the derivative gives us information about the rate of change of relationships and how the integral gives us information about accumulation. We have easily available and free technology (like Wolframalpha) that can probably do everything we need to do in our algebra courses, many of the things we do in our trig course, and even in our applied calculus course (that is in our catalog). Mathematicians have developed many powerful tools that we can share with our students, tools they could actually use outside of class. We don't need to bog them down with pencil manipulations. Instead of showing our non-STEM students how to rationalize a denominator, we could better use that time to show our students how to effectively use pencil technology to make and present good, logical, and readable mathematical presentations. In our courses, we are obligated to cover a good array of topics. There is no law that says *how* we have to cover them. We are not obligated to cover them with a pencil—we just do it because that is how we have always done it. Instead, we can cover most all the topics using technology. We just have to build a course, run it through the curriculum committee, and convince the other Nevada institutions to do the same. We can build and offer a course to our non-STEM students that teaches mathematics, not mechanics.

In his TED Talk, *Stop Teaching Calculating, Start Teaching Math*, Conrad Wolfram says what I am trying to say, but so much better. Give it a listen. http://blog.wolfram.com/2010/11/23/conrad-wolframs-ted-talk-stop-teaching-calculating-start-teaching-math/ It is worth the 19 minutes, 19 seconds.

If we really are serious about getting more people through college and on to creative and productive careers, we need to get mathematics departments to initiate radical changes. There is no "all-knowing" U.S. mathematics committee that carefully reflects on and dictates the material that should be presented in our courses. We are the people who determine that and the people who make change.

I will leave this with yet another quote, this one from Buckminster Fuller, the architect and geodesic dome guy.

> *You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.*

As evidenced by all the amazing technology around us and our most-comfortable lifestyles, I think it is clear that CC STEM textbooks and courses have done a remarkably good job. I just think that we need to take the non-STEM courses in a new direction. Maybe we can spend 2017—2019 putting together a new mathematics course for students in non-STEM programs. It could be that in the future we offer just a few STEM sections of algebra to meet the needs of students in our STEM programs and many sections of the new course to meet the needs of our non-STEM students.

Does anyone else have these same thoughts? Even sort of? Different thoughts? Please share.
This stuff is keeping me awake at night.

QED

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The Rectangle Method for Chain Rule Derivatives

Submitted by Lisa Savy, CSN

I've taught calculus for many years, both at the high school and college level. It seems the most challenging concepts for students to understand are (1) limits (2) continuity and (3) the chain rule.

One could argue that the chain rule is the most important of the three, as it occurs in nearly all subsequent derivatives. You can pass MATH 181 without a firm grasp of limits and continuity, but you can absolutely not pass without mastery of the chain rule.

Of course, we know the standard definition: $[f(g(x))]' = f'(g(x)) \cdot g'(x)$ (presuming differentiability). It looks a little less intimidating by substituting $u = g(x)$: $[f(u)]' = f'(u) \cdot u'$.

Using the words "derivative of the outside times the derivative of the inside" can be useful if you only need to take the chain rule once. More than one chain—all bets are off.

Last year, I devised a graphical method of performing the chain rule, and my highly unscientific anecdotal evidence has proven it a success.

It's a very easy method using a rectangle.

1. Identify $f(u)$ and u in the second row of the table.
2. Write their respective derivatives directly underneath them.
3. The answer comes from the bottom row of the table.
4. Replace u with the correct expression in the second row, and simplify.

$f(u)$	u

Example 1: $y = (2x+1)^5$

$f(u)$	u
u^5	$2x+1$
$5u^4$	2

$$y' = 5u^4 \cdot 2$$
$$y' = 5(2x+1)^4 \cdot 2$$
$$y' = 10(2x+1)^4$$

Example 2: $y = e^{4\sqrt{x}+x^2}$

$f(u)$	u
e^u	$4\sqrt{x}+x^2$
e^u	$\frac{2}{\sqrt{x}}+2x$

$$y' = e^u \cdot \left(\frac{2}{\sqrt{x}}+2x\right)$$
$$y' = e^{4\sqrt{x}+x^2}\left(\frac{2}{\sqrt{x}}+2x\right)$$

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This method lends itself very easily to derivatives requiring repeated used of the chain rule. Just add extra columns (and variables) as needed.

Example 3: $f(t) = \cos[(1-6t)^{\frac{2}{3}}]$

$f(u)$	u	v
$\cos u$	$v^{\frac{2}{3}}$	$1-6t$
$-\sin u$	$\left(\frac{2}{3}\right)v^{-\frac{1}{3}}$	-6

$$\begin{aligned} f'(t) &= -\sin u \cdot \left(\frac{2}{3}\right)v^{-\frac{1}{3}} \cdot (-6) \\ &= -\sin(v^{\frac{2}{3}}) \cdot \left(\frac{2}{3}\right)v^{-\frac{1}{3}} \cdot (-6) \\ &= -\sin(1-6t)^{\frac{2}{3}} \cdot \left(\frac{2}{3}\right)(1-6t)^{-\frac{1}{3}} \cdot (-6) \\ &= 4\sin(1-6t)^{\frac{2}{3}} \cdot (1-6t)^{-\frac{1}{3}} \end{aligned}$$

Example 4: $f(x) = \sec^2(\cos\sqrt{x})$

$f(u)$	u	v	w
u^2	$\sec v$	$\cos w$	$\sqrt{x}$
$2u$	$\sec v \tan v$	$-\sin w$	$\frac{1}{2\sqrt{x}}$

$$\begin{aligned} f'(x) &= 2u \cdot \sec v \tan v \cdot (-\sin w) \cdot \frac{1}{2\sqrt{x}} \\ &= \sec v \cdot \sec v \tan v \cdot (-\sin w) \cdot \frac{1}{\sqrt{x}} \\ &= \sec(\cos w) \cdot \sec(\cos w)\tan(\cos w) \cdot (-\sin w) \cdot \frac{1}{\sqrt{x}} \\ &= \sec(\cos\sqrt{x}) \cdot \sec(\cos\sqrt{x}) \cdot \tan(\cos\sqrt{x}) \cdot (-\sin\sqrt{x}) \cdot \frac{1}{\sqrt{x}} \\ &= -\frac{1}{\sqrt{x}}\sec^2(\cos\sqrt{x}) \cdot \tan(\cos\sqrt{x}) \cdot \sin\sqrt{x} \end{aligned}$$

Hope this is something you find useful. Happy derivatives!

QED