Wahpe Woyaka pi

(T a l k i n g L e a f)

South Dakota Council Teachers of Mathematics Newsletter

Presidential Ponderings

Common Core

The Common Core State Standards will be fully implemented next year. The Department of Education is continuing with their trainings to help with the implementation. Modules 3 and 4 were held during the summer and continue to be held during the school year. Part of the training included instruction and discussion concerning assessment of the standards. According to the DOE, the assessment will include performance tasks. The performance tasks will represent approximately 60% of the assessment. If you have not used performance tasks in your classroom, I would strongly suggest that you start now. Students need to be prepared for that type of assessment before being tested by the state. The DOE is also quick to point out that all information and assessments from Smarter Balanced have not yet been adopted by South Dakota.

NCTM

If you are not a member of NCTM, I would strongly encourage you to join. NCTM is coming out with many resources to help with the CCSS implementation and members receive a discount. There are many free resources available on their website.

Conference

Planning for the annual joint Math and Science Teacher's conference is well underway. I am really excited about this year's featured speakers. We are still looking for presenters for the conference. South Dakota is blessed with many outstanding math and science teachers and I hope you will consider presenting. The speakers form is available on the SDCTM website.

Jay Berglund
SDCTM President
jay.berglund@k12.sd.us

Share the Wealth

I like to include activities in each newsletter (there are three in this issue). I know that we have some of the world's best math teachers teaching in the state….and some of the most generous. However, I've come to realize that we are also some of the most modest. You never think what you are doing is "good enough" to include in the newsletter. Let me assure you that it is! If it works for your students, I know that at least one other teacher would find it helpful as well. I challenge you each to submit at least one activity...no matter how small or how large. You can include pictures of your students (and you if you'd like). Past submissions have sometimes included a student worksheet, others have not. It can be as simple or as complex as you are comfortable with. Sometimes, a simple idea (no handouts, pictures etc) can be like a gold mine to the teacher that is looking for just the right thing.

Send submissions to: smcquade2@sfcss.org

FALL2012

Wahpe Woyaka pi

Inside this issue:

Calendar Notes:

- *SDCTM/SDSTA Speaker Forms Due October 15, 2012*
- *SDCTM/SDSTA Conference February 7-9, 2013*
- *PAEMST Applications Due May 1, 2013*

"...application deadline is December 1st."

Marian Fillbrandt Endowment Funds Stipends for SDCTM/SDSTA Conference Attendance

Marian Fillbrandt graduated from South Dakota State in 1933 with a Mathematics major. She spent many years teaching math and science. She established the Fillbrandt Endowment at South Dakota State to help South Dakota math and science teachers. A committee of faculty, along with Jeff Nelson with the SDSU Foundation, has determined that this endowment can be best utilized by providing $400 stipends to second through fifth year math and science teachers to attend the SDSTA/SDCTM conference. This will allow new teachers in rural areas to interact with their colleagues with similar professional interests.

The $400 stipend intends to defray the costs of conference registration, accommodations, a substitute teacher for the Friday of the conference if a district will not provide one, and other costs associated with conference attendance.

If you are selected for this stipend, you will be required to write a brief report at the end of the conference stating how the stipend benefited you and what you learned at the conference that you plan to use in your classroom. If you are selected, but are unable to attend for some reason, the stipend money will be returned to the endowment fund. The selection committee will take financial need into account during the selection process.

The application deadline is December 1st. To apply, go to http://Fillbrandt-Teacher-Stipend.questionpro.com

SDCTM Member selected Huron High School Teacher of the Year

Last spring, Lindsey Brewer was selected Huron High School Teacher of the year. She is a 2007 graduate of Black Hills State University with a Master of Science degree in Curriculum and Instruction with an emphasis in Educational Technology and a 2004 graduate of Huron University with a Bachelors of Science degree in Math Education with a double major in Mathematics and Biology as well as a double minor in Technology and Health.

She began teaching in the fall of 2004 Howard High School in Howard, SD. While in Howard, she taught mathematics including Algebra I, Geometry, Algebra II, and Business Math. Lindsey joined the Huron School District in the fall of 2005. She has taught students Advanced Mathematics including Pre-Calculus and Functions, Statistics & Trigonometry (FST). She has also taught Integrated Math II and Algebra II as well as Health. During the 2007-2008 and 2008-2009 school years she was part-time Technology Integrationist.

Deborah Snook Selected 2011 PAEMST Awardee

Deborah Snook teaches at Phillip High School. She has taught 15 years, the last 10 at Phillip High School where she teaches Geometry, Algebra 2, Trigonometry, Pre-Calculus, Calculus, and Physics. She has also taught at Kadoka High School and Midland High School.

Deb earned her BS in Mathematics from Black Hills State University in 1995. She is pursuing a MS in Education from Southwest Minnesota State University. She continues her education by taking workshops such as TIE, AstroMath, Science on the Move, and Teacher Leadership Conference to name a few.

Deb has presented at the SDCTM/SDSTA Annual Conference and served on NCA Peer Review Team. She volunteers her time as a Civil Air Patrol member and serves as the Cadet Commander of the Pierre Squadron.

Her awards include being selected as a 2009 State Finalist for the Presidential Award, SD School of Mines and Technology Outstanding Teacher, Who's Who Among America's Teachers, National Honor Roll for Outstanding American Teachers and Enhancing Education Through Technology Awards.

Nominations for 2013 PAEMST

Know a Great 9-12 Math Teacher? Nominate him or her to receive the Presidential Teaching Award!

We're looking for outstanding 9-12 math teachers for the 2013 Presidential Awards for Excellence in Mathematics and Science Teaching. The awards are sponsored by the White House and administered by the National Science Foundation.

Every year up to 108 National Awardees each receive a $10,000 award, a paid trip for two to Washington, DC to attend a week-long series of networking opportunities and recognition events, and a special citation signed by the President of the United States.

Nominations for 9-12 teachers will be opening soon for the nation's highest honor for mathematics and science teachers. Anyone can nominate a teacher. Teachers should submit completed application materials by May 1, 2013. For more information, including nomination and application forms, please visit https://www.paemst.org/ or www.sdctm.org and click on the awards link.

Diana McCann

SD PAEMST Math Coordinator

diana@thecoganhouse.com

K-5 Corner

Remember summer? You know: June, July, and August! Those are the three months that we teachers have "off", right?!! Most of us would not agree with that statement! Rather than taking summers "off", many of us take advantage of trainings and staff development without having to prepare for a sub! This summer, I was contracted through the State Department of Education to train South Dakota teachers on the 8 Standards of Mathematical Practice, as laid out in the Common Core State Standards. It was great to see so many of you at these trainings and I always get excited to see familiar faces! However, there are many teachers who are still reluctant to make the changes needed to effectively teach the new Common Core. In our workshops, we all witnessed teachers who are hesitant to change. There will also be parents who will be confused about these "new" ways of teaching. To make the Common Core effective, we need to work together to communicate the necessity of these teaching practices. As we begin this new school year, I challenge you to find ways to present staff and parent development in these understandings! Host a math night for parents, or offer to present some information at a staff meeting! How will you get people on board?

"...we need to work together to communicate the necessity of these teaching practices."

In the meantime, check out this link to the TIE website! *http://sdcounts.tie.wikispaces.net/Math+Links* Take some time to browse through the wealth of information and ideas! If you want math games, easy access to Common Core Standards, ideas on tying reading with math, virtual manipulatives, and so much more, put this site in your favorites! You'll access it often!!

Have a great start to your school year, and keep in touch!

Lori Stverak
SDCTM Elementary Liaison
4th Grade Teacher
Robert Frost Elementary
lori.stverak@k12.sd.us

Share the Classroom Treasures

"Share the Classroom Treasures" has been a huge success at recent conferences. It is amazing the number of items that change hands! What a wonderful way to support one another.

As you are cleaning up and packing up for the summer, don't forget to put aside items for next year's conference. Keep a small (or large) box in a closet and add items that you no longer need/use.

Design A House

A measurement lesson for grades 3-5

Lori Stverak, Robert Frost Elementary
lori.stverak@k12.sd.us

Materials:

*centimeter grid paper, 4 sheets per small group of students

*rulers, 1 per small group of students

*3-foot-long butcher paper, 1 sheet per small group of students.

*sample house plan (see below)

Vocabulary: area, centimeter, dimension, distance, square feet, square centimeters, perimeter, linear feet

Instructions:

1. Tie the lesson to the real world, by telling students that people in lots of careers calculate area and perimeter as part of their jobs. Brainstorm a list of people who would need to know how to find perimeter and area. Review and discuss: What is the difference between perimeter and area? What are the formulas for finding each one?

2. Tell students that they are going to be architects. They will work in small groups to create a house for a client, Dr. Mendoza.

3. Tell the students that architects make floor plans that show a contractor how a house must be built. Pass out copies of the sample house plan to the students. Explain that this is not the house plan for Dr. Mendoza, but it shows how a floor plan matches a house. Have students discuss in their small groups how the floor plan compares with, or matches, the picture of the house and what things they notice on the floor plan. Have students share with the large group what they noted.

4. Ask students to consider the flow, or how people move from one part of the house to another. Have them imagine walking in the front door and figuring out how they would get from the kitchen to the bathroom. Help them understand how the hallway helps people move from one area to another, but having many hallways adds to the cost of the house. Tell students that in their house plans they will need to consider the flow of people, as well as the overall cost of the building.

5. Discuss how area of a house is measured (in square feet). Draw a square on the board, and label each side one foot in length. Show the students that when one dimension is a foot long and the other dimension is a foot long, the area that is identified is literally the shape of a square, which is why we call it a “square foot.” Show the students the abbreviation for square foot.

6. Last, discuss how the size of the rooms is labeled on the floor plan. Note the abbreviations for the size of the master bedroom: 13’4” x 13’4” means 13 feet, 4 inches by13 feet, 4 inches. Have the children find the area of the master bedroom and compare it to the size of their classroom to get a sense of what the area looks like. Tell the students that they will label each room with its name and the total square feet in the room. If the room is not a rectangle, they must label the dimensions of each side.

7. On the board, list the dimensions that Dr. Mendoza has for her house:
   - It must be a single story

- It can be any shape that uses whole square feet
  (Explain to students that the centimeter grid paper will be used to draw Dr. Mendoza's house plans. One square centimeter on the grid paper will equal one square foot when drawing the house.)
- The rooms can be any shape, but they must have the square footage that Dr. Mendoza requested.

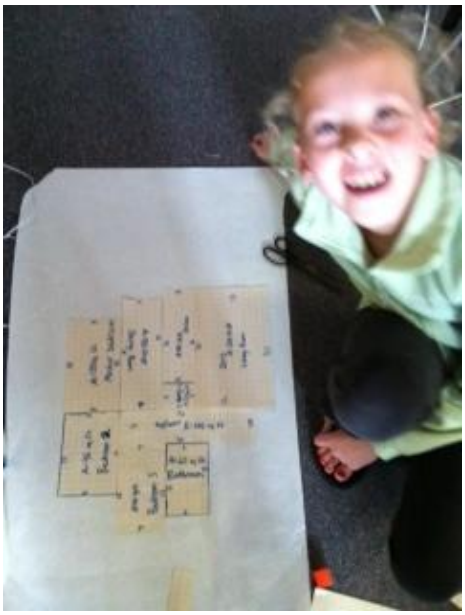
8. On the board, write the square foot requirements that Dr. Mendoza has for her house:
   - Living room: 240 square feet
   - Dining room: 120 square feet
   - Kitchen: 100 square feet
   - Bathroom: 60 square feet
   - Master bedroom: 120 square feet
   - Bedroom 2: 96 square feet
   - Bedroom 3: 84 square feet

9. Tell students that hallways can be added, but no additional rooms. Each time they add a hallway, they must label its dimensions and total square feet.

10. After students draw the rooms, they will cut them out. Then they will arrange the rooms in a way that they think is best. Remind students of the criteria they must consider: convenience, attractiveness, and cost. Tell the students that as they arrange the rooms, they must make sure that the square feet are aligned from room to room. On the board, sketch two grids that are aligned and two that are not aligned.

11. Tell students that they will tape or glue the rooms onto butcher paper. Add this information to the directions on the board:
    - Draw the rooms and cut them out.
    - Arrange the rooms so the grids are aligned. Choose the arrangement you think is the best. Consider convenience, attractiveness, and cost.
    - Glue your arrangement onto the butcher paper.

12. Last, explain to the students that after they complete the house design, they will write a letter to Dr. Mendoza, persuading her that she should consider this design for her family. Brainstorm with the students things that might convince her. The list may include things such as how attractive the design is, the flow from one room to the other, and cost. Tell the students that the letter must include the total area in the house, how they know the area of each room is correct, how they figured it out, as well as the length of the exterior walls (the perimeter) of the house. On the board, write:
    - Write a letter to Dr. Mendoza. Include:
      - The total area of the house and how you figured it out
      - The total length of the exterior walls (perimeter) and how you figured it out
      - Why she should consider your design



13. When students complete their designs, have the groups present their floor plans to the class. After each presentation, have the others ask questions to clarify information. Then ask questions yourself, as if you are Dr. Mendoza, to understand the design and to compare the relative merits of each floor plan.

    *Sizing Up Measurement: Activities for Grades 3-5 , by Chris Confer (2007)

Geometry Mobile Project

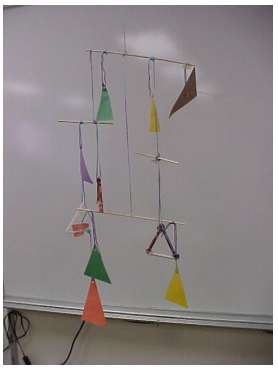
Name(s) _____

Cindy Kroon
Montrose High School
SDCTM Past President and Webmaster

I. Required Elements (2 pts. Each)

You may use any medium to illustrate each required element. Label each element.

- One pair of congruent triangles
- One isosceles triangle
- Angle bisector
- Altitude
- Median
- Perpendicular bisector
- One triangle balanced at its centroid
- Pythagorean theorem
- Illustrate one of the properties or theorems from Ch. 5
- Illustrate one of the properties or theorems from Ch. 6

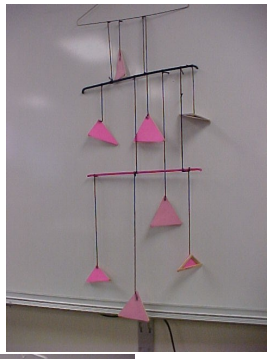


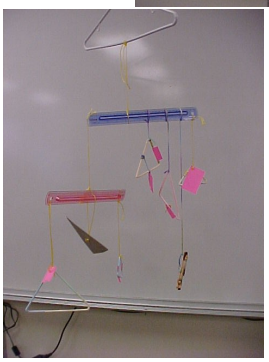
PRESENTATION (5 pts.)

- Design (must use at least two levels)
- Neatness, balance, creativity

II. TECHNOLOGY/COMMUNICATIONS (5 pts.)

- Use a digital camera to take a picture of your project. Import the picture into a Word document. Re-size the picture to approximately 2x3 inches. Add a creative title above the picture.
- Write a brief description of your mobile. Include an explanation of how your mobile meets each of the requirements above. Also discuss the following:
  - Compare your mobile with your original design and ideas.
  - If you were to make another mobile, what would you do differently?
  - What tips would you give to someone who wants to build a mobile?
  - What do you like best about your mobile?





Turn in the integrated Word document with picture, title, and written discussion.

Mobile Due Date: _____
Written Due Date: _____

College Algebra – Using your calculator to solve equations Name _____

To this point in College Algebra when I say solve the equation $x^2 - x - 2 = 0$ you would perform the following work.

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$ Factor to trinomial

$x - 2 = 0$ or $x + 1 = 0$ Set each factor equal to zero

$x = 2$ or $x = -1$ Solve each factor for the given variable

What we forget sometimes is the fact when we solve an equation, we are finding where the graph of the function crosses the x-axis. It is extremely important to relate the two concepts: solving an equation and graphing an equation and understand how they relate to each other.

We recently completed 1.4 where you were solving an equation for a given variable. You would solve an equation by factoring, extracting the root, completing the square, or the quadratic formula. In this handout, you will learn another method to solve equations; you are going to use your calculator to solve an equation for a given variable.

Example 1) Solve $x^2 - 5x - 8 = 0$.

First try to factor this equation. As you can tell, $x^2 - 5x - 8$ does not factor, therefore you must use another method to solve this equation. You can solve this equation by using the quadratic equation or by completing the square, but I would like you so solve this equation by using your calculator.

First you need to enter $x^2 - 5x - 8$ into your calculator. You can do this by pressing the "Y=" button on your calculator. Once you are in the "Y=" menu, enter your equation into "Y1". From here you want to graph your function. STOP, do not graph your function. Never press graph immediately after entering your equation into the calculator.

Before you ever press the "graph" button, you need to think about the shape of the graph you will be working with. The function is $x^2 - 5x - 8$, since the highest power is 2, you know the graph will be a parabola. In fact, the parabola will open up. How do you know the parabola opens up? You should be able to answer that question. Don't stop there, you also know the y – intercept of this parabola. "If you want to find a y-intercept, make x = 0", what is the y-intercept equal to? As you look at the equation $x^2 - 5x - 8$, approximate the roots of the equation. Since the last term is 8, I know the roots will not be smaller than negative eight or larger than positive eight. Before you press the graph button, you should always know the general shape of the graph and have an idea of what the x and y intercepts are.

Before you press graph, you will want to look at your "window" screen. The "window" is the size of your calculator window when you graph your function. The standard viewing window for your calculator is as follows.

Picture 1

Xmin = -10
Xmax = 10
Xscl = 1
Ymin = -10
Ymax = 10
Yscl = 1
Xres = 1

Your calculator window may or may not be the same as above. To get the same viewing window as above, press the zoom button. Arrow down to number 6 "Zstandard" and press "enter". By selecting "Zstandard", your window screen will now be the same window as picture 1.

When you look at your graph of the parabola, you should see a shape that looks like a parabola but the bottom of the parabola is cut off. Adjust your window size so you can see the "minimum" value of your parabola. Think, what way do I need to move my window so I can see my graph? Are you changing your x values or your y values? Adjust your window accordingly. Fill in the table below with the new window size of your calculator.

Xmin	
Xmax	
Ymin	
Ymax	

Once you have your parabola in the viewing window, you now want to solve the original equation $x^2 - 5x - 8 = 0$. Think about what this equation says, $x^2 - 5x - 8$ is equal to zero. Or in other words, graphically, when is the height of the graph is not positive, not negative, but zero. That would be whenever the graph crosses the x – axis. This would be called the x-intercepts/roots/zeros of the function. To find when the graph is equal to zero, press "CALC" (2^{nd} Trace) and select option number 2: Zero. What the calculator will do now is use approximation methods to find your root.

-Your calculator should now say "Left Bound" in the bottom left of your calculator. What the calculator is really saying is: select a point to the left of the root you want to find. We want to find the left root, so arrow to the left until you are left of the root. Then press enter. By pressing enter, you give the calculator a value to approximate the root.

-Now the calculator will say "right bound". Arrow to the right of the root you are finding, press "enter". You just gave the calculator a second value to approximate with.

-"Guess" should now appear on your calculator screen. The calculator is asking you if you want to the calculator to guess the root. Press "enter" and the root will be the x value. Do this process for the right root on the right hand of the graph.

Left Root	
Right Root	

For Your Information:

Always round your decimal values to the thousandths place unless I tell you different.

Let say for example your calculator gives you a root of $2.345E^{-7}$, what is the root?

Why did the calculator give you the root $2.345E^{-7}$ and not the actual value?

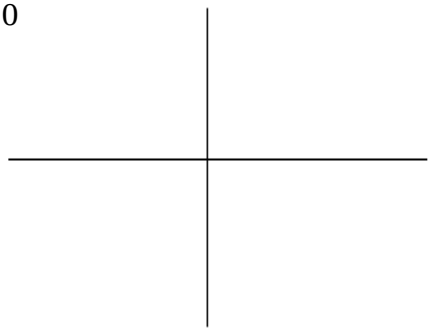
Solving equations with your calculator Name _____

Use your calculator to solve the following equations for x, complete all four tasks, A, B, C, and D.

A) Find all roots/solutions for each equation using your calculator. Round all decimals to the thousandths place.
B) After you find your solutions, copy your window screen down into the table.
C) Sketch the graph(s) from your calculator on the coordinate grid. You do not have to draw the graph to scale, it is a sketch. All critical values must be in your graph. Label your roots using an ordered pair.
D) Solve each equation by hand using the specified method. Show all work to the right of the graph. Circle your answer and leave your answer as an exact answer. i.e. no decimal answers

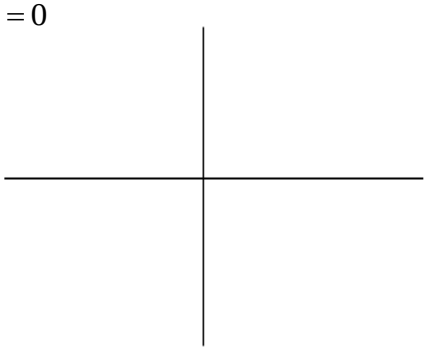
X=_____1) $x^2 - x - 3 = 0$ Quadratic Formula

Xmin	
Xmax	
Ymin	
Ymax	



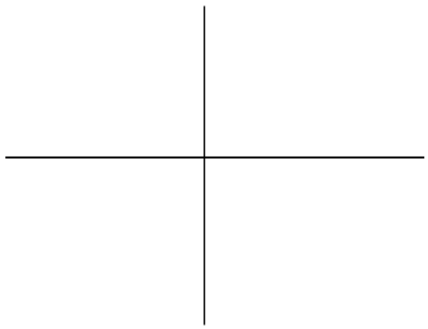
X=_____2) $x^3 + 7x^2 - 18x = 0$ Factor

Xmin	
Xmax	
Ymin	
Ymax	



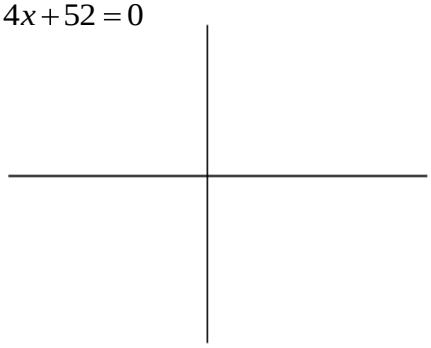
X=_____3) $x^2 - 8x - 25 = 0$ Complete the Square

Xmin	
Xmax	
Ymin	
Ymax	



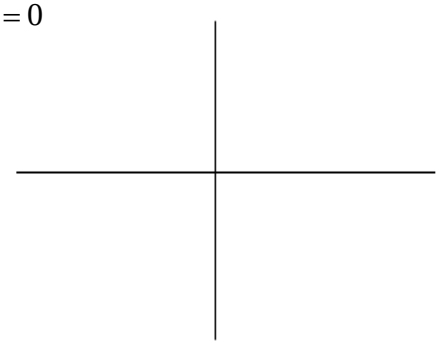
X=_____4) $x^3 - 13x^2 - 4x + 52 = 0$ Factor

Xmin	
Xmax	
Ymin	
Ymax	



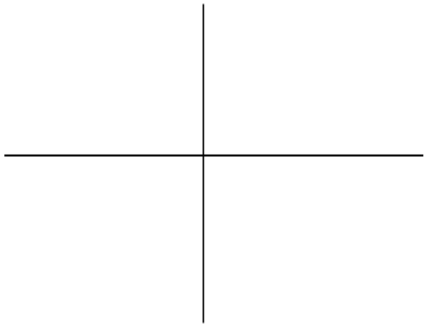
X=_____5) $\sqrt{x+4} - 5 = 0$ Solve

Xmin	
Xmax	
Ymin	
Ymax	



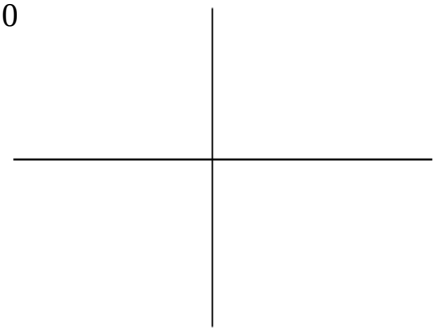
X=_____6) $|2x+5| - 20 = 0$ Solve

Xmin	
Xmax	
Ymin	
Ymax	



X=_____7) $x^2 - 289 = 0$ Extract the root and Factor

Xmin	
Xmax	
Ymin	
Ymax	



Using your calculator functions

Y=

This is where you enter in your equation. Each line represents a different function. You can enter up to 10 equations in to your calculator.

Window

The window function will tell you the size of your window. The dimensions of the window are xmin, xmax, ymin, and ymax. The Xscl and YScl tell you the size increment of each variable in the window screen. This is where you can hand enter in the window dimensions

Zoom

Under this feature of the calculator, you can adjust the size of your window without doing each xmin, xmax, ymin, and ymax separately. You can change all four dimensions at the same time. Listed are some of the main zoom feature that I use daily.

Zbox – this is useful when you want to zoom in on a certain part of your graph. You create a box and that box will be the new window for your calculator screen.

Zoom In – by selecting this function, your window will be zoomed in 4 times the previous window setting.

Zoom Out – same as zoom in but you window will be zoomed out 4 times the previous window setting

Zstandard – makes all the x and y max and min's 10 or -10

ZoomFit – This function fits your window to your graph. Be careful , sometimes this function is misleading. Before you select zoom fit, you must make sure the root of the graph is in window range of values.

GRAPH

Allows you to graph your function, you must enter an equation in the "Y=" first.

TABLE (2^{nd} Graph)

Allows you to view an x/y table of values for any function entered in to the "Y=" menu

CALC (2^{nd} Trace) -

The "CALC" menu will allow you to calculate important features of each graph. The main features are value, zero, minimum, maximum, and intersect.

Value – allows you to find the y value of a function for any given x value

Zero – finds the roots/zeros/x-intercepts of the graph

Minimum –use the same process to find the zero of a function but now finds the local minimum of the graph provided you can find an approximation point to the left and right of the minimum value

Maximum – Same as minimum but for a local maximum

Intersect – Allows you to find the where two lines intersect.

FORMAT (2^{nd} Zoom)

Format will change to "format" of the window for the graph. One can turn the x/y axis on or off. Seldom will you adjust the format of the graph.

TBLSET (2^{nd} Window)

Allows you to change the TABLE

TblStart – is the x value the table will start at

ΔTbl - Δstands for change and Tbl represents table. Thus ΔTbl stands for the change in x values for the table. Or in other words, how much does the x-value change in your table.

Indpnt: Auto Ask - If Auto is selected, the calculator will use the guidelines set forth in TblStart and ΔTbl

-if "Ask" is selected, when you press TABLE, nothing will appear. You simple input the x value you want and the y value will be calculated.

MATH

This function contains the common mathematical functions we do in class from day to day

Math- Very useful for math operations.

Num- Absolute value and other math topics are located in Num

CPX- anything you want with complex variables

PRB-All the probability you can want, main buttons are permutations and combinations

B.J. Keppen
Math Department
O'Gorman High School
bkeppen@sfcss.org

Higher Ed Viewpoint

Greetings from higher education in the state. I would like to include this short note of what higher education is doing in regards to the common core and other ties to our K-12 system as of recently.

First of all, with the common core, I think it is safe to say that higher education is going to be working very closely with Smarter Balance in making sure that the assessments align closely with expectations for entering freshman. To be honest, I think the real problems will surface and the rubber will hit the road when folks determine what to do for remediation when many students do not make the expected benchmarks for college readiness. Recently, I have heard the beginnings of talks referring to a career track as well as the college bound track. I am not sure those are official guidelines yet, but it does seem to make sense for the students. My personal impression is that we seem to be getting closer to the European training model where decisions will be made during high school as to whether a student is going to pursue a college track or a career track. I am not certain this is a good, however, it may at least point out to these late decision makers that there will be a need for them to do some retooling in order to get to the other track. I think this piece has been missing in the past and the colleges and universities have struggled to figure out how to do the remediation once they get here.

'I think that in the future the transition from high school to college will seem more seamless as higher education works much more closely with the high schools than what we have in the past."

This brings up the second piece of information I would like to share. On Monday, September 17, there were many representatives from the six different BOR institutions and some technical institutions in the state that met in Pierre to hear presentations made by Complete College America. The main objective was to try to figure out how we at the colleges and universities are going to try to get more students through the remedial and gateway courses in mathematics and English. Again there was a clear message that by the time the Smarter Balance assessments come into play, there are concerns that a large portion of students will need to have some kind of a remediation plan their senior year to try to get them ready for college. I think that in the future the transition from high school to college will seem more seamless as higher education works much more closely with the high schools than what we have in the past. I think this is a good thing as we focus on the students and their education. I do think that it is a bit unfortunate that so much focus will be spent on getting students ready for college during their senior year if they did not make the bench marks at the end of their junior year. It seems that our most talented and gifted students are not getting any attention. I do understand that these students will succeed in spite of what we do so there is not the sense of urgency. However, I would like to see those talented and gifted programs get at least some mention of coming back to the high schools. Maybe I am just ignorant and they are there already, but it is my impression that they were gone with budget cuts long ago.

If you have any questions or would like more information regarding higher education in the state, please contact me and I would be happy to see what I can find out for you. I hope to see many of you in February as we descend upon Huron for our annual SDCTM conference. Until then, best wishes for a productive semester.

Dan Van Peursem
Liaison to Higher Education for SDCTM
Department of Mathematical Sciences
The University of South Dakota

Review of Literature: Geometry Proofs in the High School Classroom

Sheila McQuade,
O[†]Gorman High School
SDCTM Newsletter Editor

Introduction

The purpose of this literature review is to consider the research that has been completed concerning teaching proofs as a part of the high school (geometry) curriculum. As a high school math teacher with 26 years of experience teaching geometry, the researcher has had the impression that the attitude towards teaching proofs has shifted over the years. The goal of this researcher is to investigate whether or not this is true and to determine how the most current research treats the teaching of proofs in high school classrooms.

The De-emphasis of Proofs

During the last decades of the twentieth century, changes in school curricula have led to a de-emphasis of proofs. Recent generations of school students and school teachers have experienced (mainly) proof-free mathematics (Gough, 2010). "Educators continue to debate the relative emphasis that formal proof should play in high school geometry" (Battista & Clements, 1995, p. 48). The National Council of Teachers of Mathematics (NCTM), "envisions classrooms in which students make, refine, and explore conjectures on the basis of evidence and use a variety of reasoning and proof techniques to confirm or disprove those conjectures" (Sriraman, 2004, p. 267). However, according to Sriraman (2004), students face challenges when expected to construct deductive arguments upon first encountering geometry in high school. The removal of proofs from the high school curriculum is, in part, due to the concern that proof was misunderstood by students as a matter of memorizing steps rather than a fluid exploratory experience. The more that curriculum emphasized the importance that students understand what they learn, the less value was placed on students memorizing technical vocabulary, definitions, formulas, and mechanical computation process (Gough, 2010). Yet, teachers and parents have the responsibility to prepare students to be independent, literate, problem solvers of tomorrow (van der Sandt, 2007).

Professional Mathematicians' use of Proofs

Most students, and teachers, believe that mathematicians make use solely of formal proof. They understand the process of proof to include logical, deductive reasoning based on axioms. But mathematicians most often find the truth by means that are intuitive or empirical. New mathematics is created by posing problems, analyzing examples, making conjectures, offering counterexamples, refining/revising conjectures until a theorem results that answers a significant question. (Battista & Clements, 1995). "When one talks to mathematicians about mathematical discovery, they acknowledge making illogical steps in arguments, wandering around in circles, trying guesses, and looking at analogous examples" (Sriraman, 2004, p. 269). Weiss, Herbst and Chen (2008) described the process as being like a "zig-zag" rather than a proceeding linearly from assumptions to conclusions. They explain that a mathematician often moves forward and backward, revisiting assumptions and reformulating definitions, and changing hypotheses to fit conclusions. This "messy, frequently chaotic path by which mathematics comes to be" is not "part of some sort of premathemathics" but lies "at the heart of mathematics itself (Weiss, Herbst, & Chen, 2008, p. 277). Mathematical work includes guessing, experimentation, plausible reasoning, and working backward. Such

"When one talks to mathematicians about mathematical discovery, they acknowledge making illogical steps in arguments, wandering around in circles, trying guesses, and looking at analogous examples"

Proofs, *continued*

"…while texts state the final product, they often erase the steps and missteps that led to the discovery …"

"…the end result of a professional mathematician's efforts and struggles is not evident in the "crisp, dry proof" the we often find in textbooks…"

thought processes are not often what one considers "mathematics" is…while texts state the final product, they often erase the steps and missteps that led to the discovery (Weiss, Herbst, & Chen, 2008). Thus, the end result of a professional mathematician's efforts and struggles is not evident in the "crisp, dry proof" the we often find in textbooks (Sriraman, 2004).

What is meant by "proof"?

In a study of mathematically gifted students and their understanding of proof, the processes used to construct a proof were visualization, intuition, empiricism, and reversibility (Sriraman, 2004). Varghese (2009) states that "proof" has different definitions or meanings to different people. He goes on to explain that the definition of proof can be based on the *concep*t of proof, the *purpose* of teaching proof, the kinds of *reasoning* involved, or the *needs* that the process of teaching and learning proof are attempting to meet. According to the National Governors Association (2010) in the Common Core State Standards for Mathematics (CCSSM), one hallmark of mathematical understanding is the ability to justify why a mathematical statement is true or where a mathematical rule comes from . "Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures" (National Board of Governors Association Center for Best Practices, Council of Chief State School Oficers, 2010, p. 6).

Alternative forms of completing proofs

According to *Using Computer-Assisted Multiple Representations in Learning Geometry Proofs*, having to memorize the many elements of learning proofs often causes cognitive overload and poses a negative effect on students' learning proofs (Wong, Yin, Yang, & Cheng, 2011). "…we believe learning of geometry can be made less difficult by employing multiple representations about geometry proofs" (Wong, Yin, Yang, & Cheng, 2011, p. 43). Those who seek to make classroom mathematics more "authentic", seek to introduce students to the practices and habits of working mathematicians and to initiate them into a community of practice. The two-column form for teaching students how to complete proofs has been used in the United States since early in the twentieth century. But the two-column form has been under scrutiny for perpetuating the image that proofs are straightforward and formal (Weiss, Herbst, & Chen, 2008).

Problem solving (and therefore proofs) would be less challenging if a student were aware of the structures of different representations and how they were interactively connected. In order for a student to be successful in proving a theorem, they must build semantic links between the geometry concepts and the features of a figure. It is through bi-conditional connections that students can clearly demonstrate the interrelation between the geometric components in a verbal description and the accompanying figure (Wong, Yin, Yang, & Cheng, 2011). "Schnotz's (2002) integrative model of text (descriptive representation) and picture (depictive representation) comprehension emphasizes that good graphic design is crucial for individuals with low prior knowledge who need pictorial support in constructing mental models" (Wong, Yin, Yang, & Cheng, 2011, p. 45). Previous studies have indicated that three types of representations should be useful for learning geometry

Proofs, *continued*

proofs…problem representation which is generally expressed as a text…visual representation which can be a static or dynamic figure… (and) the third type of problem representation is that of a proof, which can be a formal or informal proof (Weiss, Herbst, & Chen, 2008). The connection between formal two-column proof and other more informal approaches raised students' comprehension of geometry proof. Some students stated that after they understood the process of completing a proof, they hated geometry classes less than before (Wong, Yin, Yang, & Cheng, 2011).

Proofs as authentic tasks

Early in the nineteenth century students were expected to learn the proofs of established theorems as a part of the course content that students were expected to master. Mathematics courses have evolved to include the expectation that students be involved in proving original propositions on the grounds that mere reproduction of proofs from a text is not enough to engage students in authentic mathematical reasoning. Today, teachers often justify the importance of teaching/learning proofs using examples and analogies drawn from the real world: a lawyer trying to persuade a jury, a doctor trying to reach a conclusive diagnosis, a teenager trying to convince their parents of some need or want. (Weiss, Herbst, & Chen, 2008). "The imperative to prove geometric claims is thus warranted as a form of "authentic mathematics"….it helps students develop skills (logical reasoning, persuasive argumentation) that are … useful in the real world" (Weiss, Herbst, & Chen, 2008, p. 279)."While engaging students in mathematical reasoning seems to be a goal shared by nearly everyone in the mathematics education community, there seems to be little consensus regarding what distinguishes "authentic" mathematical reasoning from its "inauthentic" counterpart" (Weiss, Herbst, & Chen, 2008, p. 290). Weiss, Herbst, and Chen go on to say that many who advocate authentic mathematical proof regard the two-column form as artificial, limiting and unlike the kind of proof practiced by working mathematicians. Even so, it is unlikely that the two-column form will disappear from the high school geometry curriculum entirely. Most proof-oriented geometry curricula pay some attention to proofs written in other forms such as flow chart proofs, paragraph proofs, and proof trees even though none of these forms have taken root in classrooms to the extent that the two-column proof has. The question, then becomes not whether we should teach/use two-column proofs but to what extent and how. Research suggests that proof expressed in the two-column form can play a dual role. In many cases teachers can use the form in a way that limits a students' flexibility of thought when formulating an argument, yet in other cases teachers can use the form in such a way as to encourage even greater flexibility in reasoning (Weiss, Herbst, & Chen, 2008).

Problem-solving and learning disabled students

Students who have been diagnosed with a learning disability often struggle with mathematics computations and problem solving as well. Researchers have spent time comparing the mathematics performance of students with learning disabilities to those of students without learning disabilities. They have found that those students who have learning disabilities struggle in math even more than their peers without disabilities. Students must understand mathematical processes in order to communicate using the language of math and they should not be asked to memorize mathematics without understanding the processes of mathematics (Miller & Mercer,

"...teachers can use the form in such a way as to encourage even greater flexibility in reasoning ...

Proofs, *continued*

1997). As schools and classes become more diverse and integrated it is prudent that teachers, curriculum directors and administration keep these special populations in mind when setting standards for learning (Mercer, Harris, & Miller, 1993).

Conclusion

"If you learn mathematics by understanding the reasons for what you know, and do, then you are experiencing proof. Where you do not have proof, you have rote learning – learning something without being able to meaningfully explain it or connect it sensibly with other existing knowledge" (Gough, 2010, p. 53). Students should be exposed to the varied ways that theorems can be and have been proved. They will then not be as anxious when asked themselves to proof something. (Varghese, 2009). The most effective path to prompting meaningful use of proof in secondary school geometry to avoid formal proof for much of the students' work and to focus on justifying ideas while helping students build the visual and empirical foundations for higher levels of thought (Battista & Clements, 1995). "Although children represent only 25% of the nation's population, they represent 100% of our future. We *must* teach them well" (Mercer, Harris, & Miller, 1993, pp. 17-18).

"Although children represent only 25% of the nation's population, they represent 100% of our future. We must teach them well"

Works Cited

Battista, M. T., & Clements, D. H. (1995). Geometry and Proof. *The Mathematics Teacher , 88* (1), 48.

Gough, J. (2010). Is Proof Dead in the Computer-Age School Curriculum? *Australian Senior Mathematics Journal , 24* (2), 43-54.

Mercer, C. D., Harris, C. A., & Miller, S. P. (1993). First Invited Response: Reforming Reforms in Mathematics. *Remedial and Special Education , 14* (6), 14-19.

Miller, S. P. (1997, January/February). Educational Aspects of Mathematics Disabilities. *Journal of Learning Disabilities* , 47-56.

National Governors Association Center for Best Practices, Council of Chief State School Oficers. (2010). *Common Core State Standards for Mathematics.* Washington D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.

Sriraman, B. (2004). Gifted Ninth Graders' Notions of Proof: Investigating Parallels in Approaches of Mathematically Gifted Students and Professional Mathematicians. *Journal for the Education of the Gifted , 27* (4), 267-292.

van der Sandt, S. (2007). Pre-Service Geometry Education in South Africa: A Typical Case? *Issues in the Undergraduate Mathematics Preparation of School Teachers , 1*, 1-9.

Varghese, T. (2009, June). Secondary-level Student Teachers' Conceptions of Mathematical Proof. *Issues in the Undergraduate Mathematics Preparation of School Teachers,* , 1-14.

Weiss, M., Herbst, P., & Chen, C. (2008). Teachers' Perspectives on "Authentic Mathematics" and the Two-Column Proof. *Educational Studies in Mathematics* , 275-293.

Wong, W.-K., Yin, S.-K., Yang, H.-H., & Cheng, Y.-H. (2011). Using Computer-Assisted Multiple Representations in Learning Geometry Proofs. *Educational Technology & Society , 14* (3), 43-54.

This is a paper I wrote for a graduate class this past summer. A fellow board member encouraged me to share it with you. With the renewed emphasis on writing Geometry proofs, I thought it might be of interest. If you have completed some research or read a book/article…***please share***.

You can e-mail me at: smcquade2@sfcss.org

Math Contests

The 2013 South Dakota Science Olympiad State Tournament will be on Saturday, March 23, 2013 at The University of South Dakota in Vermillion. Some important initial documents such as: the fall invitation letter and the 2013 state tournament membership/registration form can be found as PDF files on the South Dakota Science Olympiad website (http://orgs.usd.edu/~sdscioly/). If you have any questions, please contact me.

Clark Bennett
State Director, South Dakota Science Olympiad
414 E. Clark St., Dakota 314
Vermillion, SD 57069
605-677-5248

USD will be hosting their annual Merten Hasse Math Competition for high schools on Saturday, April 6, 2013. For more information go to the website http://www.usd.edu/arts-and-sciences/math/merten-hasse-competition.cfm or e-mail Sandi.Shumaker@usd.edu

---

Northern State University's Annual Math Contest is scheduled for Wednesday, Aril 17, 2013. Please direct questions to elkhadea@northern.edu

AS Elkader
Northern University

If you have a math contest date that you would like me to include in an upcoming issue of the newsletter, please send the date and contact info to: smcquade2@sfcss.org

2013 SPEAKER / PRESENTER PROPOSAL FORM

21st Annual Joint Conference of SDCTM and SDSTA

February 7-9, 2013

Crossroads Hotel/Huron Event Center Huron, SD 1-800-876-5858

OFFICE USE ONLY:
Session No._____
Day _____
Time _____
Location_____
Repeat Session _____

Submission of this form constitutes acceptance unless otherwise notified.

All speakers must also register for the conference.

Use this form (page 2) or download from www.sdctm.org or www.sdsta.org

_____
(Name as you wish it to appear in program booklet)

_____
(Name of School/Affiliation)

Preferred Address: ☐ work ☐ home

_____
(Address)

_____
(City State Zip)

_____
(Work Phone) (Home Phone)

Email _____

Include email in program? ☐ *Yes* ☐ *No*

Website http://

_____
(Name as you wish it to appear in program booklet)

_____
(Name of School/Affiliation)

Length of presentation:	☐ one hour	☐ two hours
Date of presentation:	☐ Friday	☐ Saturday
	☐ Either day	☐ Both days
LCD projector?	☐ YES	☐ NO

Only requested equipment will be provided.

Speakers are encouraged to bring their own equipment. The conference cannot guarantee compatibility of electronic components.

Speakers are expected to bring their own computers and software.

Grade level *(select only one)*: ◯ **K-5** ◯ **6-8** ◯ **9-12**

Title of presentation: _____**Description** *(may be edited)* **max. 50 words:**

If you have a last minute change or cancellation (after midnight Feb. 6, 2013) please call Crossroads Convention Center 1-800-876-5858

Speakers are requested to provide handouts for 30 on a first come, first served basis.

Return this form by **OCTOBER 15, 2012** to:

email: jean.gomer@k12.sd.us

Jean Gomer
Box 96
White, SD 57276

Modified
03/10/12
CK

I agree to comply with the guidelines in the "Minimum Safety Guidelines for NSTA Presenters and Workshop Leaders:" during my presentation. NSTA Minimum Safety Guidelines are located online at http://www.nsta.org/coru/safety.html

Signature _____ Date _____

Contact SDCTM with any special needs requests as defined by ADA by emailing Jean Gomer at jean.gomer@k12.sd.us before October15, 2012

All speakers must also register for the conference:

Use this form (page 2) or download from www.sdsta.org or www.sdctm.org

Conference program information and booklets will be available for download from www.sdsta.org and www.sdctm.org

2013 SDCTM/SDSTA JOINT CONFERENCE

Crossroads Events Center, Huron South Dakota
February 7-9, 2013 1-800-876-5858

Conference information and program booklets will be available online at www.sdctm.org and www.sdsta.org

ADVANCE REGISTRATION --

Please print clearly. Postmark by January 20, 2013. After this date, please register on-site.

Name _____
Address _____
City, State, Zip _____
School/District _____ **E-mail** _____
Home phone _____ **School Phone** _____

Please check the appropriate categories for membership, conference registration, and payment.

1. SDCTM/SDSTA MEMBERSHIP(s) and DUES

Please check the appropriate categories. ***You may join one, both, or neither organization.***

Begin/renew SDCTM (math) for one year
- ☐ Elementary $5
- ☐ Middle School $20
- ☐ High School $20
- ☐ Post-Secondary $20
- ☐ Student $5
- ☐ Retired $5
- ☐ Other $20

Begin/renew SDSTA (science) for one year
- ☐ Elementary $5
- ☐ Middle School $20
- ☐ High School $20
- ☐ Post-Secondary $20
- ☐ Student $5
- ☐ Retired $5
- ☐ Other $20

2. CONFERENCE REGISTRATION

Please check the appropriate categories. Noon luncheon is included for each day that you register.
NOTE: The Friday night banquet is NOT included*. Banquet tickets may be purchased for $25 each.*

I will attend the conference on *(check one):* Friday Saturday Both days

SDCTM or SDSTA Member
- ☐ One day $50
- ☐ Two days $75

Non-Member
- ☐ One day $100
- ☐ Two days $125

Student Member
- ☐ One day $15
- ☐ Two days $25

College credit will be available; information/registration will be available at the conference registration table.

3. PAYMENT

Make checks payable to SDCTM.
Purchase orders will ***NOT*** *be accepted.*

Membership(s) total	$
Registration	$
Friday Night Banquet ($25 each)	$
TOTAL ENCLOSED	**$**

Requests for refunds must be received by January 20, 2013

4. SEND THIS FORM WITH PAYMENT

Steve Caron
907 South 16th Street **School phone (605) 725-8208**
Aberdeen, SD 57401 **Home phone (605) 226-2292**

Email: steve.caron@k12.sd.us

Advance registration must be postmarked by ***January 20, 2013.***
After this date, please register on-site.

Please check here if you have also submitted a speaker proposal form for the 2013 Conference. ☐

Contact SDCTM with any special needs requests as defined by ADA by emailing Jean Gomer at jean.gomer@k12.sd.us by January 13, 2013

"GOEHRING/VEITZ LEADERSHIP SCHOLARSHIP"

"The Goehring/Veitz Leadership Scholarship" has been established to encourage new teachers of math and science to become professionally involved on the state level. The scholarship, which is good for a free one or two day registration at the Joint Conference of the South Dakota Council of Teachers of Mathematics and the South Dakota Science Teachers Association, is available to any teacher who meets each of the following criteria:

- Is a K-12 teacher of math or science who is in the first year of teaching in SD
- Is a member of SDCTM and/or SDSTA Applicants must pay their own dues to the chosen organization.

The application process is simple. Fill out the form below, have it signed by the building principal, and mail it to Steve Caron along with the regular conference registration form which is available at www.sdctm.org.

APPLICATION
"GOEHRING/VEITZ LEADERSHIP SCHOLARSHIP"

Name:

School District:

Teaching Assignment:

Membership Information:

_☐_ I am already a member of SDCTM SDSTA (Circle one or both)

_☐_ I am joining SDCTM and/or SDSTA (Circle one or both)
I am enclosing a check for
_☐_ $5.00 for Elementary Math and/or $5.00 for Elementary Science
_☐_ $20.00 for MS/HS Math and/or $10.00 for MS/HS Science

(Name)_____ is in his/her first year of teaching in SD at

_____ School District during the _____ school

year and is thus eligible for 'The Goehring/Veitz Leadership Scholarship."

Signed:_____, Building Principal

Print a copy of this form. Mail with check payable to SDCTM to:

Diana McCann
31133 Bon Homme Road
Tabor, SD 57063

Name_____

School Name _____

Subjects or Grades Taught_____

Addresses

Home _____

_____

School _____

_____

Mailing Address: _____ Home _____School

Home Phone _____ School Phone _____

Fax Number _____

E-mail _____

Membership categories (Check only one)

_____ Elementary School $5.00
_____ Middle School / Junior High $20.00
_____ High School $20.00
_____ Post Secondary $20.00
_____ Retired $5.00
_____ Student $5.00
_____ Other $20.00

SDCTM Newsletter
C/o Sheila McQuade
OGHS
3201 S. Kiwanis Ave
Sioux Falls, SD 57105

2011-2013
SDCTM Executive Board Members

SDCTM President
Jay Berglund
Gettysburg High School
(605) 765-2436
jay.berglund@k12.sd.us

SDCTM Past President
Cindy Kroon
Montrose High School
(605) 363-5025
Cindy.kroon@k12.sd.us

President-Elect
Ellie Cooch
Spearfish Middle School
ecooch@spearfish.k12.sd.us

Vice-President
Steve Caron
Aberdeen Central High School
(605) 725-8208
steve.caron@k12.sd.us

Secretary
Samra Trask
Wall School District
(605) 279-2156
samra.trask@k12.sd.us

Treasurer
Diana McCann
(605) 589 - 3320
diana@thecoganhouse.com

Conference Coordinator
Jean Gomer
(605) 629-1101
jeanann@itctel.com

Elementary Liaison
Lori Stverak
Robert Frost Elementary, Sioux Falls
lori.stverak@k12.sd.us

Middle School Liaison
Becky Umenthum
Rapid City Public Schools
becky.umenthum@k12.sd.us

Secondary Liaison
Bill Gripentrog
Watertown High School
(605) 882-6316 ext. 721
william.gripentrog@k12.sd.us

Post-secondary Liaison
Dan VanPeursem
USD
dan.vanpeursem@usd.edu

NCTM Representative
Allen Hogie
Brandon Valley High School
(605) 582 - 3211
allen.hogie@k12.sd.us

Webmaster
Cindy Kroon
Montrose High School
(605) 363 - 5025
webmaster@sdctm.org

Newsletter Editor
Sheila McQuade
Sioux Falls O'Gorman High School
(605) 336 - 3644 smc-quade2@sfcss.org

SDCTM

www.sdctm.org