Adult Numeracy Network

Celebrating 25 Years!

This newsletter is published by the **Adult Numeracy Network**, Affiliate of the National Council of Teachers of Mathematics (NCTM), the Commission on Adult Basic Education (COABE), the National Coalition for Literacy (NCL), and Adults Learning Maths—a Research Forum (ALM)

Visit our website at: www.adultnumeracynetwork.org

The MATH PRACTITIONER

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FROM THE PRESIDENT

Greetings ANN Members at a Distance!

Though most of us are usually at a distance from each other, that phrase has a deeper meaning during the time of COVID-19, doesn't it? I hope that you have been feeling more at home in your Zoom calls, and I am sure that you are finding creative ways to work with your students from home when possible.

Here I present to you a "Stories" issue of *The Math Practitioner*. I usually look to *The Math Practitioner* as a place for inspiration for classroom activities or as a place to push forward my own mathematical thinking. You may find that this issue has a little bit of a different tone as we make sure to incorporate our own math stories into adult numeracy.

In this issue you can read the story of Math-on-a-Stick, where ANN Board Members and the Minnesota ABE team enjoyed math and made new friends at their 2019 State Fair. Tim Jones shares his review of a U.S. Census resource, written by Eric Appleton— a resource that underscores how compelling math data can be in telling the story of U.S. history. You can enjoy the fictional math story of Rhonda who has a lot on her mind, as narrated by Sarah Lonberg-Lew. I thank Lori Haddad for sharing her personal math story and encourage other members to share theirs in future issues or at our Ask ANN discussion forum!

Finally, Amber Fornaciari offers some suggestions for asking students about *their* math stories. Could this time of social distancing be an opportunity to ask students to share their math stories with you or with each other?

If we are able to pull off our first (I think) virtual ANN annual meeting and election, the next President's Letter you read will be from Eric Appleton from New York. Thank you, Eric, for all that you have done as President-elect and for taking on this role of President! I also want to thank all members for this opportunity to serve as the ANN President; I will be seeing you around as Past-president! Finally, If you are at all intrigued by the work of the members who have contributed to this newsletter, our website, or in a workshop, I encourage you to get more involved. After all, we are all in this together!

Wishing health and happiness to you and yours,

-Amy Vickers, ANN President

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Call for Submissions

ANN wants to celebrate the work you do!

We encourage submissions of articles, activities, and other items of interest related to math for adult learners. Below are some ideas you might consider when thinking about what to submit, but please don't feel limited to what follows.

Have you attended a great PD event that has impacted your teaching? Do you have a math task that worked so well in your class that you'd like to share it with the ANN Community?	How do you incorporate the eight math practices into your lessons? What kinds of math activities have worked well in teaching math to your ESOL students?
How do you create bridges between math and other content areas? How do you integrate WIOA objectives in your math lessons?	How do you work with students at different levels in the same class? Share an example of student work and what you learned from it.

These can be short blurbs, 350-400 words, or longer articles, 500-700+ words. Pictures or graphics are always a plus! If you send along pictures of student work or pictures of students engaging in a math activity, be sure to make sure students sign some kind of student work release form.

Finally, all issues of *The Math Practitioner* contain printable student activities. If you use one of the activities from this issue or past issues in your class, please let us know how it went! Your experience with using the problem, along with samples of your student work, could be published in our newsletter. Please direct all correspondence to:

Patricia Helmuth, Editor
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ANN Goes to Math-on-a-Stick

Minnesota State Fair—August 24, 2019

From the Editor

At the ANN Annual Board Meeting this summer, members of the ANN Board of Directors spent a day at the Minnesota State Fair. Each member spent part of the day volunteering at a very welcoming, open area of the fair grounds called Math On-A-Stick. The set up included a number of stations with manipulatives so folks of all ages could take a break from all the walking around the fair grounds, have a seat, and explore math concepts that are fun and non-intimidating. All stations had an activity that was designed to evoke curiosity and creativity about designs and patterns. They were self-directed so folks could take the activity on their own individual pathway by creating a personal design, pattern, or math moment. Some activities were quiet and reflective, while other activities got you up on your feet building larger than life patterns, jumping around, or writing on the sidewalk with chalk.

The all-day ABE Math-on-a-Stick volunteer day was organized by #IAmABE, which is a local Minnesota based group of teachers that focuses on teacher and student advocacy. Kris Klas, one of the organizers, wrote about her Practitioner Research project, Integrating Students' First Language into Math Instruction in ESL Classes, in the 2019 Spring Issue of *The Math Practitioner*.

Here are a few memorable moments from Math-on-a-Stick that the ANN Board would like to share with the greater ANN community.

Spinning Sand

At one station there was a spinning record player with sand on it. Folks could brush sand off of it or add sand as they wanted to. Then, they could use their finger or available tools to draw something in the sand on the spinning wheel. The results could be unexpected patterns or designs like the one pictured to the left. The family that made it decided that it looked like a face!

This story came in from a father who watched as his daughter was trying out the moving sand. One of the volunteers challenged her to try to draw a straight line in the sand as it was spinning and according to her father, "She looooved trying it and got pretty good at it!"

The Moving Patterns Game

There was a moving patterns game that some of us couldn't resist trying out! In groups of two or three, folks followed the directions on the pattern cards that were available. Pairs would simultaneously follow the instructions to jump, slide, step, and turn 90 or 180 degrees. Patterns and angles came to life in this engaging activity where whole body movement encourages mathematical thinking. Malke Rosenfeld is the educator who came up with the game. She has done a lot of work connecting body movement with math. She describes her game at Math on the Move.

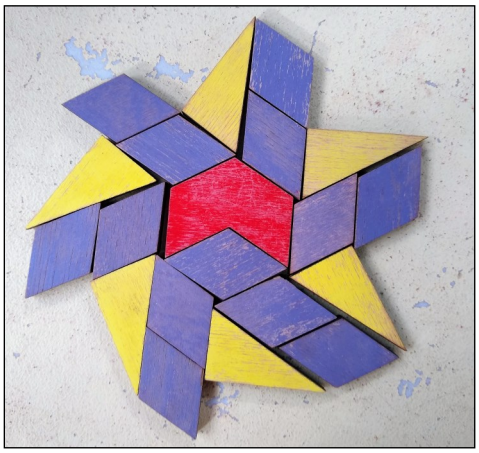
Game participants pictured are Mark Trushkowsky and Amelia Rivera. Zdenka Guadarrama is facilitating the game.

Mark Trushkowsky, pictured on the left, had this to say about why he jumped into the game and then reflected on his takeaways:

"I had been looking at the Moving Patterns station from a safe distance for a few minutes when Chris invited me over to try it with him. I am really glad he did. Just looking, I was able to appreciate how it used dance steps to create rigid transformations, especially slides (translations) and turns (rotations), with your body. But it was very different to do it with my actual body. Especially when I was dancing with another person, because the way I was moving was being reflected by my partner across the line between us and the symmetry was fun to watch (and to create). Translating the clear visual choreography symbols into movement also made for all these other patterns, especially sounds (a step, a pivot on the pavement, a jump). I found the more I danced with a partner, the more timing became an element and another layer of the physical mathematics we were performing. The station had a book of moves, with each new card getting increasingly complex. It was the first time I ever worked up a sweat doing math—in a good way."

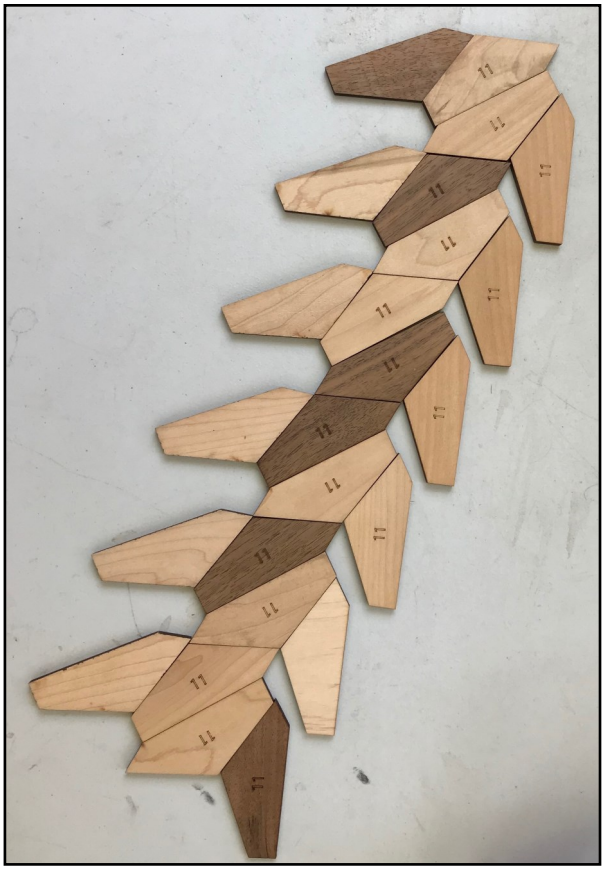
Zdenka Guadarrama, the volunteer pictured above, is a math professor at Rockhurst University who travelled to the State Fair just to visit Math-on-a-Stick! She does a lot of interesting work including a Mathapalooza Room, where students of all ages can explore and discover mathematics in an interactive environment. Similar to Math-on-a-Stick, the goal is for students to see themselves as a math person, capable of developing their own understanding of mathematics.

Pattern Blocks



This colorful pattern was made by a girl, about 9 years old, whose family was heading down the sidewalk saying, "We're leaving" and "Walking now!" to her. Her brother was picking her up by her waist as she was still finishing her shape. He finally set her down, she finished, and only then ran to catch up with them. This really underscores how our brains are naturally inclined to seek and create patterns, which can lead to lots of higher-level mathematical thinking. What math comes to your mind when you look at this pattern?

I sat at a station and watched as some teenagers created what you see pictured on the right. I thought this might be fertile ground for a Number Talk so I asked, “I wonder how many elevens there are in that design?” They counted and settled on 17. I pushed: “I wonder if we could figure out the total value of all those elevens by doing mental math?” They thought about it and initially, came up with different totals.



I asked how they were thinking about it. One young girl said, “Well, I multiplied 10 x 17 in my head and came up with 170. Then I multiplied 1 x 17 and added that to the 170. The total would be 187.” Her friend disagreed, “No. It’s easier to multiply 10 x 11, which equals 110 and then 7 x 11, which equals 77. When you add them up you get 187.”

Now they had the same totals but were thinking about it two different ways! It felt pretty great to be sitting at a fair grounds in a relaxed atmosphere and listen to these young folks talk about how they were thinking mathematically about a pattern that they themselves created. I ended my shift feeling pretty good about being there that day.

The ANN Board would like to thank Christopher Danielson and the organizers of Math-On-A-Stick for all the work they did putting the activities together and for reserving volunteer time slots for us so we could participate. Many thanks also to the local Minnesota adult basic education (ABE) and adult numeracy community leaders for getting the word out locally and the Minnesota ABE volunteers who worked alongside the ANN board that day. It was a wonderful experience for all of us. Thank you!

EDUCATE IN PLACE

Math Resources for Our Homebound Students

From the Editor

Shelter in place has taken on new meaning for us all. In the word of adult education, the impact of the order to "stay at home" has been particularly troublesome. Many programs lack the resources and funding to make this a smooth transition and even if those resources were to emerge, teachers would need training in order to be able to use them effectively.

However, there is a lot of chatter amongst adult educators who are dedicated to staying connected with their students. Those adult education communities that we belong to are united in sharing resources that we can use to ease ourselves and our students into this virtual learning environment. The purpose of this article is to pass on some of the resources that we have found to be useful and effective during this difficult time.

Staying Connected

Google Classroom is a free virtual classroom space that allows you to make announcements, start a discussion that students can participate in, post assignments, create links to online resources, communicate directly with individual students via email, and more! One nice feature of Google classroom is that your students can access it by phone, tablet, or laptop. There is a free app that students can download onto their phone or device to stay connected. To find out how to make the most of your Google Classroom go to Google Teach From Home.

Math Resources

Desmos has hundreds of digital math activities that are free, engaging, and cover a wide range of math topics. As students work through a Desmos activity, they will be asked to explain their thinking on an activity. Their responses are then visible to other students. I like this feature because it helps students to maintain that sense of community with their classmates. You can simply send a link to all your students via email, text, or your Google Classroom. When I was new to Desmos, I found the article that Connie Rivera wrote in the Spring, 2019 issue of *The Math Practitioner,* How Does Using Desmos Fit in My Classroom?, very helpful in terms of learning how to navigate the activities.

NYSED/CUNY Fast Track GRASP Math Learning Modules are packets that are designed for self-paced independent study practice in high-priority topics that appear on high school equivalency exams. Students develop underlying concepts as an introduction to each topic and then practice applying what they have learned in context. The packets also include test practice and an answer key with explanations. Language support is included in each packet so low literacy and ESL students can work through the packets independently. (See pages 12 & 13 of this issue for sample pages from Probability & Statistics, Part 1.)

Students can print them out at home or use PDF editing software to annotate the materials. These packets are free and ideal for independent study if you are not able to meet with your students in an online learning environment. The topics include:

- Density: Area & Population Density (Part 1)
- Density: Volume & Density of Matter (Part 2)
- Rigid Transformations: Shapes on a Plane, Part 1
- Rigid Transformations: Shapes on a Plane, Part 2
- Lines, Angles, & Shapes: Measuring Our World, Part 1
- Lines, Angles, & Shapes: Measuring Our World, Part 2
- The Power of Exponents, Part 1
- The Power of Exponents, Part 2
- Tools of Algebra: Expressions, Equations, and Inequalities, Part 1
- Tools of Algebra: Expressions, Equations, and Inequalities, Part 2
- Probability & Statistics, Part 1
- Probability & Statistics, Part 2
- Tools of Algebra: Linear Functions, Part 1
- Tools of Algebra: Linear Functions, Part 2
- Tools of Algebra: Nonlinear Functions, Part 1
- Tools of Algebra: Nonlinear Functions, Part 2

Educational technology is the norm in the K-12 system and adult education is moving in that direction. We can help acclimate our students by creating an online classroom where technology resources are always available. If the program where you teach already has an online platform set up for you to communicate with your students, great! If not, you could use Google Classroom or Edmodo to set up your own classroom. Once your online space is established, you can upload assignments to your classroom or share links with your students so they can access interactive educational tools or resources.

I created a Google Classroom when I first started teaching a Fast Track GRASP Math Class about two years ago as a way to create and maintain a community of learners that reached beyond the two days we met in a traditional classroom each week. I might post a notice/wonder activity, pictures of student work or activities, congratulations to students who passed the HSE exam, or make an announcement about upcoming math topics. I didn't get as much conversation going as I had hoped I would but something interesting did happen. Sometimes I would get responses from students who had stopped out. They would explain why they hadn't been to class and would often express a desire to resume their studies. Later, when our in-person classes closed abruptly because of the COVID-19 pandemic, there was a lifeline in place. It certainly wasn't seamless moving to a completely online environment, but it was a piece of stability that we could move forward with.

We, as adult education instructors, are used to thinking out-of-the-box to help our students to move forward. I'm proud to be part of such an amazing community that is working hard to stay connected to our students. We're all doing whatever it takes. In fact, we'd like to hear your stories. What are you doing to stay in touch with your students? How have your students responded to the transition from in-person to online instruction? Please send your stories to the editor of *The Math Practitioner*, Patricia Helmuth, at mathpractitioner@gmail.com and your story may be published in an upcoming issue. You can also share your stories at our online discussion forum in the LINCS Community at Ask ANN. Hoping to hear from you soon!

The U.S. Census: Integrating Social Studies and Math

by Tim Jones

With more than two decades as a math and science teacher in secondary and adult education, Tim Jones now serves as a Math and Science content specialist in the Adult Education Programs and Policy Office at the New York State Education Department.

I just reviewed, and highly recommend, the recently-released adult education resource on the U. S. Census. It is authored by Eric Appleton and available on CollectEdNY at:

http://www.collectedny.org/frameworkposts/the-united-states-census-math-and-social-studies-lesson/

This 28-page lesson integrates valuable HSE-level math and social studies, while informing and encouraging participation in the Census. The text is reading-level appropriate for adults, culturally sensitive, and a very engaging and educational read.

DISTICTS	Free white Males of 16 years and upwards, including heads of families.	Free white Males under sixteen years.	Free white Females, including heads of families.	All other free persons.	Slaves.	Total.
Vermont	22435	22328	40505	255	16	85539
N. Hampshire	36086	34851	70160	630	158	141885
Maine	24384	24748	46870	538	NONE	96540
Massachusetts	95453	87289	190582	5463	NONE	378787
Rhode Island	16019	15799	32652	3407	948	68825
Connecticut	60523	54403	117448	2808	2764	237946
New York	83700	78122	152320	4654	21324	340120
New Jersey	45251	41416	83287	2762	11423	184139
Pennsylvania	110788	106948	206363	6537	3737	434373
Delaware	11783	12143	22384	3899	8887	59094
Maryland	55915	51339	101395	8043	103036	319728
Virginia	110936	116135	215046	12866	292627	747610
Kentucky	15154	17057	28922	114	12430	73677
N. Carolina	69988	77506	140710	4975	100572	393751
S. Carolina	35576	37722	66880	1801	107094	249073
Georgia	13103	14044	25739	398	29264	82548
	807094	791850	1541263	59150	694280	3893635

Several historically accurate graphs, tables, and diagrams are incorporated to teach graph interpretation, and have Adult Ed students apply arithmetic, practice with percentages, and learn problem-solving skills through stimulating, high-interest questions. High School Equivalency exams integrate math into the Social Studies and Science Subtests with similar test items.

The constitutional establishment of the U. S. government, the history of when various groups of people gained political rights, and how the census works for congressional apportionment are among the many civic-minded Social Studies topics that are presented in ways that are reachable and relatable for both HSE and ESL students.

The 2020 Census is now underway and ongoing—adapting or delaying their operations in response to COVID-19. We should do whatever we can to help spread the word about this excellent, timely, and free resource that is packed with so much good stuff!

Rhonda Reasoner Ruminates on Ratios

By Sarah Lonberg-Lew

The domain of proportional reasoning is rich and deep, but unfortunately in many classrooms it is reduced to a single procedure that, while effective, is difficult to make sense of. I'm talking about cross-multiplication, that fun little trick where you multiply the numbers that are diagonally across from each other in a proportion and get the same value for each product. It allows you to write a tidy little equation to solve for the unknown. For example:

$$\frac{6}{11} = \frac{9}{x}$$

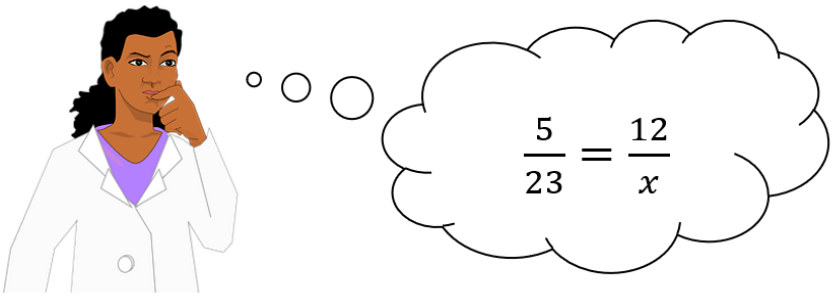
$$6x = 99$$

$$x = 16.5$$

Some people call it the butterfly method because drawing loops around the numbers to be multiplied gives you a little picture of a butterfly, but it has nothing to do with butterflies. And as it's taught, so cute and easy to remember, it has nothing to do with reasoning either.

Where in the world did this neat little trick come from? Did someone just happen to notice one day that the products of the diagonals in a true proportion are equal? I doubt it. My guess is that it was the result of some reasoning, some noticing, and some wondering. Here's how I imagine it might have happened. (This is a work of fiction - any similarity to real people, places, or events is unintentional.)

Once upon a time, Rhonda Reasoner was reflecting on some related ratios.

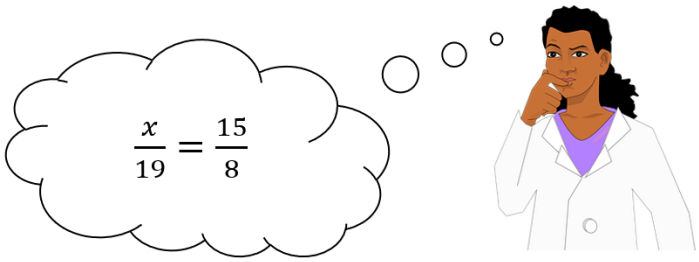


Hmmm, she thought, I don't see any easy way to find the unknown number. I'd like to use the property of equal ratios and multiply the 5 and the 23 by the same number to produce a ratio that matches the one on right, but I don't know what I can multiply 5 by to get 12!

But, I know that multiplication is related to division and if I'm stuck thinking about multiplying, maybe thinking about dividing will help! If I use division to figure out how many 5s there are in 12, I can multiply 5 by that number to get 12. Let's see: 12 ÷ 5 = 2.4, so that means that if I multiply 2.4 by 5, I'll get 12. (Of course she double checked by doing the multiplication and found she was right.) That means that 2.4 is the multiplier

that will turn my left hand ratio into the right hand one. The unknown number is 55.2!

Rhonda had found what she was looking for, but rather than rhapsodic, she felt reflective. I wonder if doing the same steps works with other ratios? she wondered. It only took two steps: one division and one multiplication. Let me see if I can do a proportion that's set up differently with similar reasoning.



This time I'll divide 19 by 8 to figure out what number can be multiplied by 8 to get 19. Then I can multiply 15 by that same number to get x. Let's try— I know that 19 ÷ 8 = 2.375. If I multiply 15 x 2.375 it equals 35.625. That means the missing number is 35.625!

Because Rhonda was so rational, she wanted to make sure her answer was reasonable. In my right hand ratio, she thought, I have the top number being almost twice as big as the bottom number. I know that 35.625 is almost twice as big as 19, so I feel pretty good about that answer. I think I've made a discovery! I'll bet I can solve any proportion with one division and one multiplication – division to find the number to multiply by and then use multiplication to find the missing number! I'm sure glad I was able to make use of the structure of the relationship of multiplication and division and recognize the regularity in my repeated reasoning!

Rhonda was so excited, that she ran to tell her friend Polly Procedure about the discovery she had made. Polly was properly pleased, but wondered if there were a way to make this process more pleasant. Said Polly to Rhonda, *I notice that each time you are dividing the number that's in the ratio by the one across from it and then multiplying that result by the third number, you find the unknown number. But what if you did the multiplication first? Doing the math in a diagonal design would be delightfully decorative!*

Rhonda ruminated on whether she could achieve the same results by multiplying diagonally and then dividing. She tried it with the same ratio, this time switching the order and doing 19 multiplied by 15 and then divided by 8 and it gave her the same result! The product along each diagonal was the same number. Multiplying 19 by 15, or 8 by 35.625 both came out to 285.

Polly procedure was pleased as punch with this payoff. *Now people will be able to process proportions without reasoning at all!* she said. *They can just multiply the numbers that are diagonally across and then divide by the third number! And it makes a pretty butterfly pattern when you draw loops around the numbers you are multiplying. We can call it the butterfly method!*

But Rhonda found the recommendation rather repellent. *If people preferred Polly's pretty procedure,* she thought, *they would miss out on rich reasoning with ratios! Getting the answer fast may feel good in the moment, but it just doesn't measure up to the rush of a good round of reasoning! Students who are only taught Polly's procedure will never know what great reasoners they can be!*

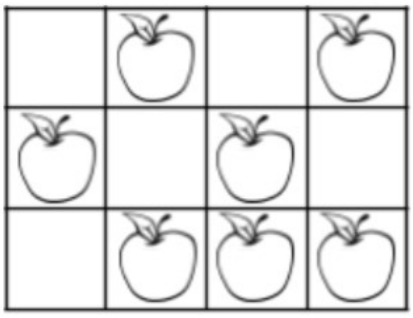
Rhonda's regrets really resonate with me. I see the *real* value of a mathematical education as becoming numerate, learning to think critically and logically, and learning to recognize and reason about patterns and relationships. These are the things Rhonda experienced in the (admittedly silly) story above. When we teach students only the results of the experience of reasoning and don't let them have the experience themselves, we may be helping them pick up a few points quickly on a test, but we are also depriving them of the most valuable benefit of studying math. If we want our students to become numerate, we must let them struggle through messy reasoning instead of giving them pretty polished procedures that someone else struggled for.

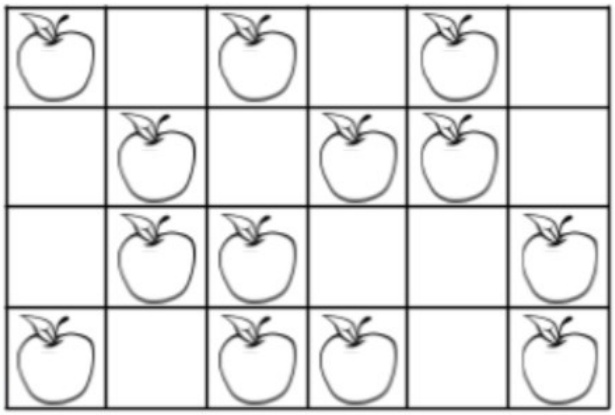
Here's a snag, though. Many of us did not struggle for the strategies we use ourselves. They were given to us and that's why it feels natural to give them to our students. It can be especially scary to ask students to struggle through creating their own strategies if we don't feel we could do that ourselves. But remember that there was a time before these strategies existed and we and our students are as capable of creating strategies as Rhonda (or whoever it was that really came up with cross-multiplication).

What if instead of…	**You...**
Teaching students cross-multiplication,	Gave them the tools to understand the meaning of a proportion and then let them struggle with messy numbers? (See Rigorous Proportional Reasoning: So Much More than the Cross Product by Melissa Braaten—*The Math Practitioner* Vol 23, Issue 2)
Teaching students the procedure for multiplying 2-digit numbers,	Helped them build an understanding of the meaning of multiplication and then let them work to make sense of multiplying larger numbers? Area models are a great tool for this! (See Reasoning About Multiplication Facts with the Area Model by Sarah Lonberg-Lew—*The Math Practitioner* Vol 25, Issue 1)
Teaching students to divide fractions with invert and multiply,	Gave them space to extend their understanding of division with whole numbers to division with fractions? (See What Does Fraction Division Look Like? by Patricia Helmuth—*The Math Practitioner* Vol 24, Issue 3)
Teaching students to follow steps that you were taught to follow,	Charted your own paths through problem solving together? I dare you!

Comparing Ratios

The two drawings below show apples compared with area (the total number of squares)[1].

A) 

B) 

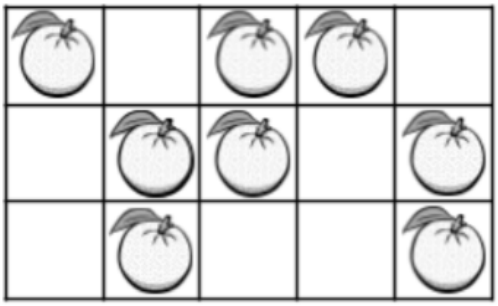
1) What do you notice?

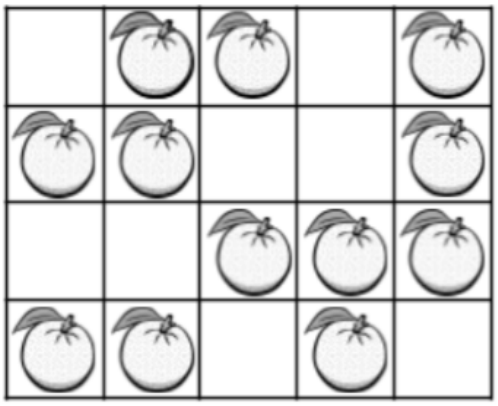
2) In image A, there is a ratio of 7 apples to 12 squares. This can also be written as 7:12 or $\frac{7\ apples}{12\ squares}$. This ratio is equivalent to $\frac{\quad}{24}$ and $\frac{\quad}{48}$.

3) In image B, there is a ratio of _____ apples to _____ squares. This can also be written as ___ :24 or $\frac{apples}{24\ squares}$. This ratio is equivalent to $\frac{\quad}{48}$ and $\frac{\quad}{12}$.

4) Which image is more crowded with apples? In other words, which image has a larger number of apples per area?

[1]Apples per area is similar to population density, which is a topic on the high school equivalency exam. See Area & Population Density and Volume & the Density of Matter for more practice with density.

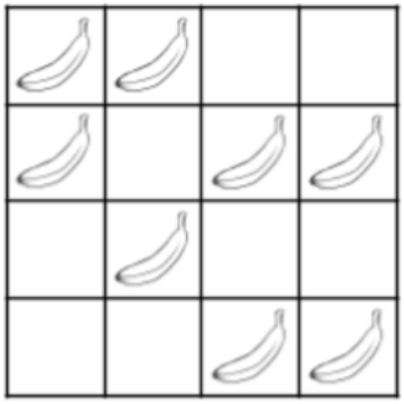
C) 

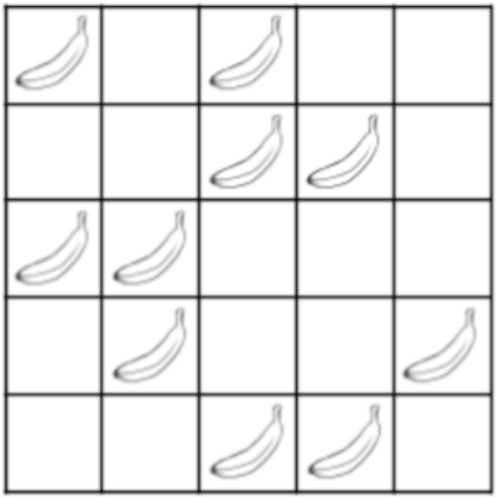
D) 

5) In image C, the ratio of $\frac{oranges}{15\ squares}$ is equivalent to $\frac{\quad}{30}$, $\frac{\quad}{45}$, and $\frac{\quad}{60}$.

6) In image D, the ratio of $\frac{oranges}{squares}$ is equivalent to $\frac{\quad}{40}$, $\frac{\quad}{60}$, and $\frac{\quad}{80}$.

7) Which image above has a greater number of oranges per area? How do you know?

E) 

F) 

8) Which image has a higher density of bananas per area?

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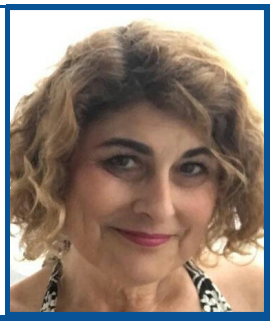
Source: www.collectedny.org

My (Math) horror story

by Lori Haddad



Lori Haddad is an instructor, academic guide and education consultant at The Office of Community Corrections in Fitchburg, MA. She has been enjoying this occupation since 2001, when she began her teaching career at The Worcester County Jail and House of Corrections. She has a Bachelor of Arts in English from Worcester State College, and has recently enrolled in a Master's of Education program at the same University.

The terrors began young.

I could count, sure. In fact, my first grade teacher made Nancy, Lisa and me the "milk money girls." That was back when kids brought in nickels, dimes and pennies for the daily little glass bottles of milk—the actual cost of which I have forgotten. The best and brightest were the milk money counters. I remember piling dimes into little towers at the teacher's desk and squatting down to count each silver disk. I liked being among the smart and dutiful chosen children.

What happened?

I suppose "plus and minus" things were okay in second grade but in third grade I recall standing in a back corner while the teacher drilled flash cards for my multiplication edification.

Fast forward to fourth grade when long division reared its ugly head, and I was from then on adrift in a sea of numerals. The next year, in fifth grade when my teacher would ask, aloud, in rapid-fire sequence what's something-plus-some-number-minus-something else-times-whatever- and so forth, I was hopelessly lost while Paul, Timmy or Michael popped out the answer.

In the sixth grade, I remember being called upon during a math lesson by an apprentice teacher and being stumped. I don't remember the question, but I do recall glancing at the old pendulum clock above the door (escape route) which indicated nearly lunch time, and Mr. B. saying, "Don't bother checking the clock; you still gotta answer the question."

I now ask myself, why, oh why, didn't I ask my seventh-grade teacher to explain mysterious math things that I didn't understand, like: ***Why*** does ½ equal 0.5? One evening as I sat at the desk of my bedroom's

west-facing window trying to do my homework and watching the sun go down, I was thinking, "The half and 0.5 must be the same, just because someone decided they were."

Math and I have never been on good terms—couldn't find an equal footing—always out of balance. Even in junior college when I enrolled in a pharmacy technician certificate program, I had trouble with the pharmacy math which consisted largely of ratios, per cents, and the metric system. Metrics! Don't even get me started. What went wrong? Afterward, I endured the nagging feeling and accompanying shame that math had kept me from attending pharmacy school, although I did work as a tech for many years. My math issues felt like a dormant virus, incurable, for most of my life. And the long-standing but convincing myth that "you're either a math person or you're not" didn't help. I felt alone.

The purpose of writing and sharing this backstory is not to disclose the troubles and trauma of being math-deficient, but rather to highlight the context in which I saw myself in past years before my current occupation as an adult education instructor. When I was assigned this position at a correctional facility, it was predominantly to teach reading and writing. Eventually the job grew along with program needs, and my old math demons began to appear. As many a teacher before me, I referenced the ancient workbooks in the classroom that I'd inherited, and that was enough to coast along. For a while.

Enter new challenges, in the form of updated GED and HiSET tests. And still, more than ever, that haunted feeling of algebra-dread. Then one day, it hit me hard: my job had been transferred out of the jail to a community correctional setting where probationers attend a day program. One day a young woman client came to me in a tizzy. She explained that her eighth-grade son was failing math, and asked if I would help her to help him. Of course, I did wish to be of assistance. The next day, she handed me a disorganized collection of worksheets from various sources and said, "Here it is." This happened around April or May, and I guess it was a school year's-worth of stuff. So I retreated to my classroom and begin to look it over. Horrors. What's this?! Input/output tables? Graphing of functions? Linear equations, and systems thereof? Oh, boy. Yeah, I knew about plotting points on a grid and had dabbled with slope, and understood basic stuff about balancing equations, but yikes. I was stymied. The guilty feeling of, "How can I be in this profession/ position/ predicament, and call myself a teacher?" It was disturbing and disorienting. It was like a house of horrors, or at least a house of mirrors where every image is distorted. I realized I'd been living in a math nether-world. It and the real world were about to collide.

I turned to any and every resource I could think of: the kid's teacher (no response), a book editor (who nicely did write back), an engineer friend, the engineer's meteorologist friend, the engineer's wife (a math teacher), a tutoring service, a neighbor who is a retired science teacher, some online stuff, and more. All the while I was in this panic thinking: "And I'm supposed to be a state-certified GED instructor?!"

I dog-paddled around in over-my-head math waters. I had turned to my Massachusetts Department of Elementary and Secondary Education (DESE) Licensure mentor and friend, Carey Reid, to ask if he might direct me to some much-needed math help and support. He referred me to Donna Curry at the Mathematics and Adult Numeracy Curriculum and Instruction PD Center, part of Massachusetts' System for Adult Basic Education System (SABES). Through her kind and sage advice, I was encouraged to attend the SABES workshop "Making Sense of Fractions." From there, I discovered the learning opportunities and brilliant math experts who make it their mission to help students of math gain insight and confidence. With people like Donna, Sarah Lonberg-Lew, Connie Rivera and Pam Meader, I have learned to regard math with curiosity and observation rather than fear and dread. Every workshop I've attended with them (such as Singapore Strips and Area Models, Making sense of Fractions, Proportional Reasoning, and Intro to Linear Equations) has helped me cultivate a better regard and appreciation of math's wonders.

With their excellent presentations based in real-world contexts and offering a "low floor/high ceiling" ideas for exploring reason and patterns in math, the SABES Math Team and the Adult Numeracy Network have helped me see that learners can relax, be comfortable and even find pleasure and fun in math challenges. They have changed my life. It's been only two years since I discovered SABES and ANN. Working with and learning from these math communities has helped wash away the heartache and paralyzing pessimism that was so emotionally destructive to my self-regard because I lacked numeric confidence. I've wondered, "Why didn't I seek these resources out years ago?" It was because I was still afraid of math, in subtle denial, believing that I still couldn't handle it.

I really could go on to infinity about the support I've received and continue to receive from my new math tribe through SABES and ANN. This crowd and their patient, welcoming assistance has opened doors to me I had beforehand thought permanently shut. And I love being able to share my new-found math happiness with other beginning students. The alteration of a fixed mindset to a growth mindset is so liberating. Every day, I enjoy imparting a measure of math empowerment to new and math-phobic learners. The struggles are real but so are the rewards, no matter how small; they're not insignificant. I never thought I 'd be writing about the emotional impact of math learning, but because of people like Donna, Sarah, Connie, Pam and so many others I've met, I can feel safe sharing and showing other apprehensive learners that there's a way to get through math challenges we previously thought insurmountable.

Resources

Learn more about the math professional development organizations mentioned in Lori's story.

- Adult Numeracy Network: www.adultnumeracynetwork.org
- SABES: www.sabes.org

What is a math story?

by Amber Fornaciari

In short, math stories are recollections of people's past experiences with math or evolution of how they view the use of math in their lives. These autobiographical writings can go back as far as childhood or simply back just a few years. Students are asked to share their journey honestly, as a way to honor what they are bringing to the classroom not only as mathematicians, but as people.

As in the previous article titled, "My Math Horror Story", the writer moves through a progression of math instruction throughout her life. Students often share similar stories, like the one below:

> "People who are good at math are lucky. I'm jealous of anyone who is good at math. I have a learning disability with math that makes it hard to comprehend it. It's basically always been this way. It takes me so long to learn something and then the next day I won't remember a single thing from it. My step-dad used to get super mad at me because after learning something I would say I didn't know how to do it the next day. So whenever I think of math I think about feeling helpless as my step-dad yelled at me for not knowing how to do a problem." - Elijah Whitehouse

Since a math story is such a personal experience, math stories can vary greatly from person to person. For instance, a math story doesn't have to be a horror story. See the example below.

A math story in the country—Oscar Lopez

"I never thought I would be remembering how I began to use math in my younger years, maybe from 8 years to 13 years old. It was always in the morning from 4:00 am to 6:00 or 7:00 A.M. when my father took me to go and get water to a place approximately a half mile away. We had to walk up the hill with two empty metal 5 gallons containers. When we got to the destination, we waited in line be cause sometimes there were already people waiting in line. I don't know if we had to wait for 20 or 30 minutes to fill the containers. We filled them ¾ full so the water didn't spill on the way down the hill. A couple of breaks were needed along the way because the water was very heavy. When we arrived back home, we emptied the water in a bigger container and did it all over again. This process went up to three times every morning before breakfast and school. I used math to remember how much water I brought back to our home with my papa. I also used math to time how long each trip took so I could be back in time for school. Each trip took longer than the

The previous trip because each trip was more tiring. I added up time for walking, collecting the water, and walking home times the number of trips. Sometimes people would be waiting at 4:00 AM for this filtered water. I could carry about 8 gallons; 4 gallons on each side of the shoulder carrier. This experience has taught me how to estimate the needed amount of water for a variety of jobs such as 1 bucket of water to wash a car.

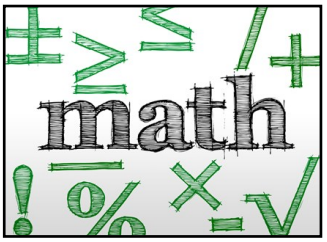
When I was 8 years old I worked a lot, but I enjoyed learning math. The multiplication tables for 7s and 8s were difficult for me, but today they come easily for me. I get excited to learn something new. When I get stuck on new math, I feel like it holds me back.

At 15, I quit school to work in construction. It was in 1985. I needed math for measuring materials and weight for mixing cement, sand, and gravel in Kilograms. I measured oils to put on top of the support for the frame. We used the metric system in Mexico. I learned to use numbers to figure out my pay for my work. I didn't have formal schooling again until the middle of 2017 when I attended Elgin Community College (ECC).

Learning math has helped me become more efficient and not waste energy. When I am working at the warehouse math is very helpful in determining how much work can be completed in two hours. I determine how many people are needed and how much time needs to be allotted.

My goal is to earn my GED, continue my education to be my own boss, and have my own business. Math is important for mechanics and computers. My boss comes to me for advice about things he may not know because he knows I will figure it out or know it. Math has helped me become a problem solver. I feel math keeps my mind sharp!"

Often times, when students begins writing their math stories, it is the first time they are actively reflecting on their experiences with the subject or learning at all, like in Tyree's example below.



"When I think of math, I think this is a subject I Don't wanna do, me and math Don't get along. I think why Do i have to do math cause I'm Def not good at it. I would like to understand math so I can Help my Kids have a better understanding". -Tyree Brown

Benefits of Math Stories

There are numerous benefits to gathering and writing math stories. Adult learners rarely are asked to share their opinions or reflections on their education or math learning. Those can be powerful thoughts for students to build on and revisit as they spend time in a classroom—be it face-to-face or online.

When we come to know and connect with our students more deeply, we build a foundation for all our future interactions. When learners can trust teachers with their personal opinion or stories, this can promote student retention, which in turn helps those students reach their educational goals.

I personally have had many moments where I was able to approach students or differentiate my instruction in a way that benefited their learning because of their math stories. For example, just knowing that a student has test anxiety helps me to frame tests in a less threatening way, teach testing strategies, and figure out ways to help that student with that particular challenge.

Reading a story like Elijah's can be heartbreaking but so informative. As an instructor I now know that Elijah struggles with math, may need extra support, and might have some trauma in his past that affects his learning. When I read a story like Oscar's I immediately think, this student knows how to persevere and be a leader. How can I help that student use those skills to learn? When I read a story like Tyree's I see a yearning for understanding.

The most rewarding benefit of the math story activity is featured below.

> "Throughout my life I have always had a difficult time with school, but nothing compared to my difficulties in math. I just could never grasp the concepts as quickly as other students, and my anxiety disorder prevented me from asking questions. I always felt like a bother,and I didn't want to hold my class behind with all of my silly questions. I was embarrassed that I didn't understand the content, when it seemed like everyone else did. As I got older, my anxiety disorder worsened and I developed depression. School became my worst enemy. It was less of a learning environment, and more of a place I'd go to have panic attacks. It became apparent that public school was not working for me, as I spent most of my time hiding in the bathrooms instead of attending class. I dropped out of school my freshman year to focus on my mental health. After taking a year and a half off of school, I registered for G.E.D classes at Elgin Community College (ECC). I was so nervous to be attending school again, but I was hopeful that I'd have a different experience. I started with learning basic math such as addition, subtraction, and multiplication. I caught on quickly, but it saddened me that my old school district had let me pass all the way through my freshman year without have a solid grasp on these foundational concepts. Luckily for me ECC was nothing like my past experiences with school! The classes were smaller, the teachers were more personable, and best of all I didn't have to raise my hand to go to the bathroom. I felt so much more respected here than I did in high school. My teachers felt like teachers, and not like authority figures. I don't fear that I'm being judged by the other students when I ask questions, because we all are there to learn and support each other. It's empowering that we are all working towards the same goal. I no longer feel shame about my math skills, and am excited to go to school each day. I may not be getting my education in the most conventional way, but I'm proud of myself for acknowledging my differences and doing what works best for me!" - Noelle Tuegel

Hearing that a student has found her niche within the program but also found that she can be successful with math is not only affirmation for the individual instructor but also inspiration for other students.

How Do I Implement Math Stories?

The first step is to spend time reflecting on your own math story. The actual activity of writing out your own math story produces similar emotions to what students may feel when they are asked to complete this activity. Some students may also feel more comfortable opening up if they know that you have made yourself vulnerable too.

Second, plan time to dedicate to the math story activity. An instructor should think about timing within a term, session, semester or class. When will students be most receptive? When will it make sense to fit this into my day? Some instructors use this as a first week or beginning of the term activity while others wait until they have formed more of a relationship with their students. To avoid making the very first day of class stressful, it is best to not to use this as a first day activity. It is important to respect that student expectations for the first day of class will likely not include divulging their past or writing something personal.

Step three includes executing the activity. A sample mini-lesson for this activity is below:

Objective - Students will write a math story.

Introduction - What is a math story? Everyone has one. We've all encountered math in our lives in different ways with differing emotions. Math may or may not be your favorite subject, but you've come in contact with it at some point in your life and that is where we are going to start with this activity.

Model

- Teacher shares a small portion of their own math story.
- Teacher shares other examples of a math story, which could be from a previous student or any other source.
- This video, from Story Strong, has a great example of an oral math story.

Activity - Ask students to write their own math story using one of the prompts given. Students may write with just one prompt or a combination of prompts. A sample student prompt sheet follows this article.

Giving students choices in the prompts allows students more equity in accessing the prompts, which in turn, allows for a variety of thoughts of math to be expressed. For some examples of math prompts that one teacher has gathered and found to be very helpful in terms of encouraging her students to view themselves as capable math people, go to Corwin Connect.

Writing math stories can easily be adapted to meet the needs or preferences of your students. The task can be changed to drawing a picture or images to tell their stories if writing isn't the best fit. Very general sentence frames can also be used to get students started, but the magic from the task comes from the open-endedness of the prompts.

Students could produce their stories by typing or writing or by creating a video or slideshow. I tend to have them simply write it or type it the first time. Be flexible - it could be written in a student's native language and translated later.

Next, **read and reflect**. Not only is reading the math stories fascinating, and sometimes emotional, but it also provides instructors with a window into their students math world that they might otherwise never have known. Look to the next issue of *The Math Practitioner* for more about meaningful next steps for the math stories that you collect.

References:

My Math Story and Identity, Story Strong, Angel, Murray Hill MS, Class of 2022
Getting the Most Out of Math Portfolios, Margie Pearse, Corwin Connect, September 02, 2016

Editor's Note:

The COVID-19 pandemic may bring up math fears our students have that they cannot recognize or define. They are seeing a lot of numbers in the news—big numbers—that even the experts are scrambling to make sense of. What, for example, is the difference between the mortality rate of seasonal influenza, which is about 0.1% and the mortality rate of COVID-19, which worldwide is about 5% (as of this writing). If you still have contact with your students via distance learning, consider sharing with them the student pages included in this issue as an introduction to ratios. Demystifying those numbers will enable our students to feel more empowered at a time when many feel powerless.

When Amber wrote this article about collecting student math stories, she probably had in mind asking students to write about their math stories whilst in the classroom. What if we ask them to write stories now, though, as students are learning at a distance? What would we find out? Would their stories be different somehow? Would students have more time to reflect as they write the stories? Would they feel more comfortable sharing their true feelings as they write from home instead of in the classroom? Would their math stories be in some way associated with COVID-19?

We have a unique opportunity to find out. On the page following this article you will find some prompts you could use to get your students thinking about their math stories. If you choose to ask your students to write these stories, please share them with the ANN community at Ask ANN or email me at mathpractitioner@gmail.com. Please ask your students to sign a student work release form if you plan to share the stories. We eagerly wait to hear from you.

MY MATH STORY

Everyone has a math story. What is yours?

Here are some questions or topics to help you get started. You do NOT have to answer all of these, they are just ideas to get you thinking.

Throughout my life my experience with math has been…

My best experience with math was when…

My worst experience with math was when…

How do you use math in your daily life?

When I think of math...I think…

My family feels that math is…

People who are good at math...

Happy 100 Years!

Here's another math story—NCTM is celebrating 100 years! We would like to acknowledge that the story of the Adult Numeracy Network (ANN) is grounded in support we received from NCTM. In the early 1990s, adult basic education teachers approached NCTM and asked them to extend their agenda to include adults. NCTM responded by co-sponsoring the *Working Conference on Adult Mathematical Literacy*, which took place over three days in March 1994 in Arlington, Virginia. That event served as the launch of ANN.

Now NCTM is inviting ANN members to join NCTM in celebrating their Centennial with **100 Days of Professional Learning**—**live, free webinars** presented by speakers who were originally scheduled to present at the NCTM Centennial Annual Meeting in Chicago (canceled due to COVID-19). Each webinar will be held at 7 p.m. Eastern time on 100 selected days from April 1 leading up to the October NCTM 2020 Annual Meeting & Exposition in St. Louis. According to NCTM, A variety of speakers and topics will be offered which will include **all grade bands and interests**.

Visit **nctm.org/100** **to register** for sessions, to **keep up-to-date on the schedule** of sessions, and in the future to **access recordings** of previous sessions.

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS
CELEBRATING 100 YEARS

What is ANN?

We are a community dedicated to quality mathematics instruction at the adult level. We encourage collaboration and leadership, and we influence policy and practice in adult math instruction.

Benefits of being an ANN member:

- Opportunities to contribute to a national community of adult numeracy practitioners
- The ANN Annual Meeting with a sponsored strand at the national COABE Conference
- *The Math Practitioner* newsletter which includes:
  - ◊ The latest in adult ed math news
  - ◊ Samples of successful exercises, lessons, and teaching practices
  - ◊ National and regional conference updates
  - ◊ Research information applicable to adult ed math instruction
- A nationwide professional network that provides a forum for professional development and an avenue of support for efforts to improve standards in adult numeracy

YOU CAN NOW JOIN ONLINE!

https://www.adultnumeracynetwork.org/Membership

A one-year membership for a single individual is only **$20.00.**

See our website for details on savings for two- or three-year memberships.

To receive a complementary one-year membership:

1) **Register for our annual conference or**
2) **Write an article for *The Math Practitioner***

To inquire about group memberships or to pay for your membership with a check, please access the printable membership application form or contact:

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