Sol Lederman (SL): Welcome, everyone, to [Inspired by Math!](#). In this podcast series, I interview people who are inspired by math and who are inspiring others. I'm really excited this afternoon to be interviewing a couple of people who are very involved in the [Albany Area Math Circle](#), Albany being Albany, New York, and I have with me Gili Rusak, who is a 10th grader, a sophomore at Shaker High School, and she has been very much involved in creating community, and, in fact, I learned about Gili and her work through a blog article that Mary O'Keeffe, being the other person I have with me on the phone here. Mary wrote an [article](#) bragging about Gili's work, and after reading the article I realized I needed to interview both of them for the podcast series, so I reached out and they were both happy to do it, so I have Gili Rusak and I have Mary O'Keeffe with me, so welcome Gili and Mary!

Mary O'Keeffe (MOK): We're happy to be here.

Gili Rusak (GR): Very happy. Thank you!

SL: Yeah, so I had the two of them send me bios, and I can't read their entire bios because we don't have enough time, but I will give some of the highlights from what they sent me. Both of them have done really, really impressive things, which is why I'm very excited to have them with me, because those of you who have listened to this podcast series for a while realize that what I'm really excited about is changing people's stories of what math is, right? We have a lot of pressure in the American culture to think that math is this difficult and boring and uninspiring thing, and the people I get on this podcast series tell a whole much happier story.

So, anyway, so as I mentioned, Gili is a 10th grader, she has been building math community, she has been working with the middle school students, in particular girls from her area, she's been creating treasure hunts and we're going to talk about that, she's working on a research project on Twitter network communications among teenagers. Gili volunteers as a tutor with this math circle helping the younger students comprehend difficult mathematical concepts, she tutors at an inner-city middle school in Troy, New York, she's a member of the Colonie Youth Court working with first-time offender peers, she has volunteered and mentored at the Science and Technology Entry Program, she's a tutor, she's been involved since sixth grade in math competitions, also in computer science competitions, first place and gold medal in the regional ACTR Olympiada of Spoken Russian for New York, more medals related to Russian, she's taken college courses, and the list goes on and on. So that's very impressive, Gili, and we will be asking you to fill in some of the details on some of what you're up to.

Okay, and then Mary also sent me good information for her bio. So Mary's the founding advisor of this Albany Area Math Circle, she is a consultant with Miller Risk Advisors, she's a co-organizer of Math Prize for Girls at MIT, she teaches public finance at Union College in upstate New York, including a service learning course in which economics majors prepare tax returns for low-income working families and seniors, she has an A.B. in mathematics from Bryn Mawr College, summa cum laude, Ph.D. in economics from Harvard, she's taught in some very high-profile schools, including Caltech, Harvard, a number of honors including the Harvard KSG

Carballo Award for Excellence in Teaching and Public Service, let's see, the MAA's Sliffe Award for Distinguished High School Mathematics Teaching, U.S. Presidential Scholar Teaching Recognition Award, and Mary, I'm going to give you an opportunity in our interview to tell us about your daughter and what's extra special about her.

So again, welcome, Mary and Gili!

GR: Thank you!

MOK: Thank you!

5:10 SL: Okay! Alright. So let's dive into the questions. So Mary, tell us your story of founding the Albany Area Math Circle, and in particular, being an economics and a finance person, you found yourself leading math circles.

MOK: Well, I have two daughters, and they both love math, and enjoy doing it within our family, but almost 20 years ago, I first heard about the idea of a math circle, shortly after Bob and Ellen Kaplan started up the Boston Math Circle in 1994. And it seemed like such a wonderful idea, and I kept wishing we had one here. I kept thinking to myself, "Someone should start a math circle here. Someone should start a math circle here." We used to live in Boston, when my oldest daughter was little we'd lived in Boston, and I thought, why did we ever move away? It just seemed like such a wonderful community. But I didn't really feel that I myself was competent to start one, and so I kept saying to myself for years and years, well, we really should have one here, someone should really start one. And then a few years later, in 1998, I read about the Berkeley Math Circle, which was another of the earliest math circles in this country, and that was started up by Zvezda Stankova, also a graduate of Bryn Mawr College, and I thought, oh, this is wonderful, we should have one here.

Well, by 2001, seven years after I first started hearing about math circles, my daughter Alison Miller was a sophomore in high school--actually, the same age as Gili is now--and we still didn't have a math circle, and I realized one wasn't going to happen if we didn't make it happened. So, although I had been laboring for years under the impression that one somehow had to be divinely anointed, or at least have professional math credentials beyond what I had, which were an undergraduate degree in math and a Ph.D. in mathematical economics, I just, we just took the plunge and made it happen, and we first networked with a computer scientist at RPI in Troy, Mukkai Krishnamoorthy, who had a son attending--a ninth grader, a year behind Alison, at Troy High School. And that was the nucleus, back in 2001. We found a few other students, I think we had maybe six students at our first meeting. And Alison, my daughter, who was a sophomore in high school back then, well, she's now in her fourth year of graduate school in math at Princeton, and my co-advisor's son Raju is also in a math Ph.D. program at Columbia, but the two of us still spend our Friday evenings working with this wonderful community that has grown, starting with those six students. We now have about fifty students who come weekly to our math circle. There's probably a hundred students who come at least once a month, we have students with

many different interests, but that's basically the story.

SL: So you've been doing a weekly math circle for the last twelve, thirteen years?

MOK: Yes! We do only run it from roughly November to May each year, but yes.

SL: Right. That is, that's fantastic, and to have so much consistency, and people coming that regularly, that's really cool.

MOK: One of the really fun things is that during--we meet even during school vacations and breaks, and our alums come back, the ones that are out in college or graduate school or the real world, they come back when they're visiting during those vacation times.

SL: Wow. So it's really become a community, a family, it sounds like.

MOK: Indeed.

SL: Very cool.

9:43 Okay, next question is for Gili. So tell our listeners, did you always enjoy math, even when you were very little?

GR: Yeah. Math has always come very naturally to me, since a very early age. With my dad being an aeronautical engineering professor, there was always a lot of math in the house always. So since I had a natural instinct towards math, my parents encouraged it from a very early age, and I vaguely remember driving to nursery school and counting with my mom by twos and then by fives, by threes... and then when I was a little older, my brother actually, who is now at Stanford University for grad school, he made packets for me and filled them with difficult math problems. And I remember the joy it gave me when he encouraged me and joked around how I'm solving problems that even people his age couldn't solve. And because of all this encouragement at home, I remember always being bored during math class. But then I met Mary and started going to math circle around sixth grade. This really changed my entire vision on math, completely. The problems were a lot harder, the kids were a lot smarter, and it was really a great experience for me.

SL: Okay, cool. Now, I'm curious, Gili: do you remember any of these early difficult problems that your brother gave you?

GR: I remember we used to do a lot of division. He'd give me a really long string of numbers, and then he'd tell me to divide it by three, for example. And sometimes it would work, and sometimes I'd have to get a remainder.

SL: Okay, alright. And so from these humble beginnings you got into more math and being in

math circle and creating your own events and being a leader, from these humble beginnings of doing division, huh?

GR: Yeah. (laughs)

SL: Okay, well, that's a cool story, maybe that'll get more people interested in doing their division problems.

GR: Definitely.

SL: 11:52 Yes, okay, so Mary, next question is for you. In your bio, you said that your love about teaching is really about learning with others. So I'm curious to know if there's a story about where that love came from.

MOK: Yes, so when I was a child I attended highly regimented, drill-oriented Catholic schools in the 1960s with very large classrooms, 56 students per room, and the beleaguered teachers really didn't have much alternative to that highly regimented learning. But at home, I had a librarian dad. Now, unlike Gili's family, my family was not a mathy family. But my dad loved to help others find out the answers to their questions. He didn't have the answers to all the questions, but he loved to help us discover things. And he was curious about everything, and he loved to argue in good-natured ways with others. He was definitely not a math person; in fact, he briefly, in desperation, for one year took a job as a substitute uncertified math teacher, and it was like, he told us later this was the *worst* job of his entire life, that it was worse than being a bill collector for Liberty Loans, it was worse than being a roofer's assistant in Washington DC on hot roofs with tar. That was how uncomfortable he was with math. He was a poet and humanities guy; he was interested in philosophy and theology, politics and literature. But he gave me the courage to just explore and realize that learning didn't just have to happen in the classroom. And there were a lot of shortcomings in our school, and that actually turned out to be a big advantage, because I wound up--my brothers and sisters and I, we were all about a year behind the students in the public schools where we would be ultimately transferring into those schools later in our high school careers. And so I discovered that I really loved to help my younger [*sister*] and brother learn math and help them catch up, and I enjoyed that, actually, so much, and I learned so much from that experience because they pushed me with their questions, they made me think about things that I thought I already knew, and I just appreciated and understood so much more about it. There's this notion I think some people have that doing mathematics should be only slightly less private than your sex life, and I learned from doing math with my younger brother and sister on the steamy hot front porch with the popsicles dripping over our scratch paper that anything is more fun when you do it in a group. I didn't even know how much I liked math until my younger brother and sister came to me for help. So that's my story.

SL: Yes, you know, I have to say I resonate with your story, because I, for about a year, a couple years back, led a math circle here where I live in Santa Fe, New Mexico. And I absolutely went out of my way to not do any teaching. I would come up with interesting problems and I would

write on the whiteboard and everybody would have scrap paper and crayons and scissors, whatever we needed for our exploration, and I would go around the room and encourage people to explore and to help each other and yes, I was holding the space and helping it to move if it got stuck, but it was much more gratifying for me to experience the aha! moments of the people in the circles, and there were a mix: there were adults, and there were children, and every time someone had an aha!, I felt much, much better than if I had just given someone an answer, and the more interesting problems are open-ended and don't have such an easy answer anyway. So yes, I get your story.

16:51 Along the same lines as passion and love and inspiration... so, Gili, what inspires you to create community there? There are certainly people who are brilliant mathematicians, there are people who are inspired community builders, and there are people who are young, but to combine all three of them in one person really is extremely rare. So I want to know what your secret is, Gili.

GR: (laughs) Thank you. So I'd have to say that really, my own experience is what pushed me to create these communities and to really enjoy math so much. Like, for example, working with my brother, it was really a great joy to me, like, it made me happy, it made me feel smart, and that's what I liked. And later, when I got to math circle in sixth and seventh grade, I worked with the older high school students, and that also really encouraged me. From a young age, I'd always liked working in small groups, even just two or three people, as opposed to working by myself, where it's always stressful and I'm always trying to get every single problem right. Because that's a lot... when you work in a group, it's a lot less pressure on you to not make a mistake, or not know how to solve a problem. So now that I'm a little older and I have a chance to inspire younger kids, like junior high kids, I really like these opportunities, because I know where the, like, I've been in their shoes. I know how stressful it is when someone gives you a problem and you read it and you don't understand one word of it. I love creating communities of others who are like me, and seeing the joy on everyone's faces when they learn a new concept or solve a really hard problem, like you guys were talking about before. I remember how it was exactly like that when I was younger.

It also helps when you actually explain a problem to a younger student and they understand it, it really helps you yourself gain confidence. For example, when I tutor my inner-city students for MathCounts, I tend to try to explain to them the problems myself instead of just throwing answers at them. When you create a community, you really never know when someone is going to start looking up to you. For example, when I worked, when I was in sixth and seventh grade, I worked with students who are now at MIT, at Stanford, and I really looked up to them, and I still communicate with them today.

SL: Yeah, that is really cool. I think, Mary, you referred to this in one of your blog articles, I think, if I'm remembering correctly, about paying it forward?

MOK: Right, right.

SL: Yeah, and this is great, just, you know, just help everyone you can. So a couple of comments I wanted to make about what you just said, Gili. One is, I completely agree that there is a great power in doing math exploration in groups, because then people aren't under pressure, and I know some people really believe that it's more important to work one-on-one with people, and I'm sure in some cases that's true, but people who are really afraid of math can get very intimidated--

GR: Yeah.

SL: --also, sometimes, when it's one-on-one. And then another thing that I remembered, or thought about when you were sharing is, right, there's this notion--and I don't know if I agree with it completely, but this notion that you don't really understand something unless you can explain it to a five-year-old.

GR: (laughs)

SL: And I think there's a good amount of truth to that. And like any truism, it's certainly not always going to be true, but there is a challenge, a wonderful challenge in taking--

GR: Right.

SL: --difficult ideas and making them understandable by younger folks. Oh, and I have to say that I absolutely love, Gili, how you referred to yourself when you were younger. You are young. (laughs)

MOK: (laughs)

SL: "When I was younger..." It's great.

21:15 Okay, next question for Mary. So Mary, you've won lots of awards, but I know that you're much more interested in bragging about the many honors that your students have won. So tell us about some of those.

MOK: Okay. Well, first of all, I have to say, my mantra is, "There are many ways to measure success." We've had lots of student honors in our math contests, like MathCounts, the AMC Olympiad series of contests, ARML, we've had students go to National MathCounts, we even had one of our students, Andrew Ardito, was the national runner-up at National MathCounts in 2006. We've had quite a few students make the USA Math Olympiad and the Junior Math Olympiad, students do very well at ARML. We managed, one year, we had a number of students on the only ARML team to solve the fifteen-person relay [Upstate NY]. We've won Power, our students have won Power Rounds, I love the collaboration.

So we've won lots of honors, and now, this year, for the first time, we have [three students](#) who are being honored for their research, and Gili is one of those. Last week, Gili won first place in the local Science and Engineering Fair, which means that she will represent our region at the international, the Intel International Science and Engineering Fair in Phoenix.

SL: Wow. Congratulations!

GR: Thank you.

MOK: In May. Which is really exciting, and I'm especially excited, because this has actually been a dream of mine for a long time, is to get our students doing original research, and we have three students this year who've all done original research that they've gotten significant honors for, and they're actually all presenting tonight, as sort of a dress rehearsal for, they'll be presenting it at an undergraduate math conference in a week or so, but I'm really excited. They're doing this presentation tonight at our math circle for our younger students, and hopefully inspire some of them. So that's exciting.

We also have had students excel in many other areas, the sciences, Physics Olympiads, computer science contests, computational linguistics... some of our students, it's even very cool, I think, we have a lot of Renaissance people who have also won notable honors in the humanities, National History Day, music awards. I love this notion, "Do math, and you can do anything!"

But, as I say, there are many ways to measure success. We have a [Hall of Fame](#) on our website, and I list some of the notable awards that students have won. But before you get to those, the students at the very top are the students who have created community, students like Gili who have created events for younger students, who have coached younger students, who have led middle school math circles of their own, or who have just been exceptionally welcoming to other students in our math circle. [*mok: I was remiss in not talking about our Heart and Soul award winners: [Dave Bieber and Andrew Ardito](#) and [Beth Schaffer](#) and [Drew Besse](#).*]

Now, you mentioned my older daughter Alison Miller a little while earlier.

SL: Mm-hm.

MOK: So she won two significant awards that are very meaningful to me in the summer of 2004, and one of them is very well-known, and the other one is not but actually resonates much more deeply.

So in 2004 Alison was on the USA team at the International Math Olympiad, and she was only the second woman ever to make that team, which is generally almost entirely male, and she won a gold medal at the International Math Olympiad, which was, she was the first American woman to do that. So that was very exciting.

But there was something else that she won that summer that means even more to me. So at the Olympiad training camp, which takes place every year in Lincoln, Nebraska, which brings together about sixty students, some students preparing to be on the current year's IMO team, and some students who are considered strong prospects for future teams. So there's roughly two groups, they're known as the veterans and the rookies. Usually there's about roughly half and half veterans and rookies, veterans have been there at least once before. And there's an award, an unofficial reward that's voted by the rookies, "Most Welcoming Vet". And Alison tied for Most Welcoming Vet with another student that year.

And to me, that was even more important, even more meaningful, the fact that she was someone... the Olympiad training camp, that's a pretty scary place. I mean, I still remember when she first went in 2000, it was a very scary place, and there was a somewhat older young woman, actually, just at the end of her freshman year in college, Melanie Wood, who made an *enormous* difference, being very welcoming and encouraging to Alison. And so then four years later for Alison to win that recognition, and then, in turn, she helped create the math circle here, and she has coached many students, and they've coached other students, and they've coached other students... I think Gili must be something like my mathematical great-great-great-grandchild or something like that, because she didn't get to work with Alison directly, but there are students that she worked with that worked with... maybe it's not quite that many generations, but I have quite a few generations in thirteen years.

So that, as I say, that's my biggest thing that I love to brag about is not just the accomplishments of the students, the honors and the trophies and medals and so on, because those are fundamentally ephemeral. I see those as an ends to a means, the means is creating a community of kindred spirits who love to do math together, who love to encourage each other, and keep them from getting discouraged when there are setbacks or things go wrong, which they definitely do. [mok: I totally screwed up this last sentence! I said completely the opposite of what I meant since I reversed the words ends and means!] Problem solving is about problems, and they wouldn't be problems if they were easy to solve.

SL: I love your point about the importance of community, and congratulations to you and to Alison for both of those accomplishments, and I wanted to say, Mary, that your answer reminded me of this really wonderful quote, and it's one of these things that somebody shared on Facebook, and it has always stuck with me. It says something like, "Life is all about relationships. Everything else is detail."

MOK: (laughs)

SL: Right? And I think that's what you're saying--

MOK: Right.

SL: --is that the important thing is about the community, about family, about people supporting one another, and yes, and when you support one another then people go out and bring back trophies for the team, and that's wonderful too. But without the community it would be a much less accomplishment. So that's what's very exciting about what the two of you and you and Gili and many others are doing to move this community forward, and to keep it alive and vibrant.

30:15 Speaking of math circles, let's go into a little bit of detail. Gili, when I read your article, the one in the Albany Area Math Circle, "Gili Rusak, mathematical community builder," I got very interested in what you were doing with Treasure Hunt, the kinds of problems you explore, about the fact that you collaborate, which is a really wonderful way, it's a recurring theme in this conversation, about the importance of collaboration for doing math, and the joy that you and others have experienced. So this is a big open question for you, Gili. Tell us about your experiences in this circle.

GR: Yeah. So, actually, my experience all started last year, when I attended a SUMiT program at MIT that was run by Dr. Ken Fan [from Girls' Angle]. Before I attended this program, all I knew about math was math, learning math, math contests, and math tests at school. However, at SUMiT--what SUMiT was, it was a program where a bunch of girls from all around came to MIT, and we collaboratively solved a crossword puzzle throughout the day, and at the end we received little prizes. So at SUMiT, my entire vision on math actually changed. Here it was all collaborative, and it was a lot of fun, and I made new friends... as opposed to math contests, which were always stressful for me.

So I came home, and I decided that I wanted to also make one of these for the local junior high kids around my own area. So what I did is I contacted Mary, and we decided that we should start off the year with a math treasure hunt. So I gathered a group of junior high girls, and I only asked girls to come at first, in order for them to gain the experience and gain confidence with problems and problem-solving, et cetera. So I gathered a group of junior high girls and invited them to a local--to Union College, a room in Union College [the Kenney Community Center]--and they collaboratively solved a problem set that I made up for them. These problems were similar to the ones that they experienced in MathCounts and on the AMCs. What I did is I put the girls' nametags in such a way that older, more experienced girls sat next to younger, less experienced girls, and acted as leaders for them, for the less experienced girls. It was really fascinating how the older girls really reached out to the younger girls and solved all the problems. What happened is, at the end, there was only one problem left for everyone to collaborate on, so all the sixteen girls in the group had to come together and try to solve together this one last problem, which was the hardest one. And once they all got it, they were all very happy, and they were all joyful, and it was just so great to see. They opened the treasure box and they got their prizes, and even the prizes, I organized them in such a way that they were fitting. I had Chinese checkers, brainteasers, tic-tac-toe, and other little prizes to further inspire their imagination and problem-solving skills. It was really nice to see them all working together, engaged and excited about math, like I did when I was younger.

So the groups are always really diverse. I invite a bunch of people, some that attend our math circle, some from a local STEP program that Mary helps with, and I try to incorporate local inner-city students who otherwise would not have an opportunity to pursue math in a different way other than school. So I provide them an opportunity, and it really makes a difference: you can see the joy on the faces.

For example--I'd like to give one example from my very recent treasure hunt, actually just last week.

SL: Mm-hm.

GR: Yeah, so it was the first time that I had invited boys to my treasure hunt, because I decided that it would be the last treasure hunt of the year, so why not? And it was a really different experience, and it actually worked out very well. There was a lot more excitement in the room, and the kids were--some of them got very excited. (laughs) So there were actually two boys from a local inner-city school, and they both came from a very troubled family. They were at first, they sat together, they were brothers, they were very shy, and they didn't even want to look at the problems. But I heard from from other people that actually, their grades at school were slipping, and they were very surprised to even be invited to such an event. But as the day went on, I actually set them up with some older students who mentored them, and really, they started--they really clicked, they clicked. They started solving problems, they went up to the board and wrote their answers, and they even got really, they were really happy to do it. And I was so glad that they could come and join us, because otherwise they wouldn't have this opportunity to at all engage in math, and I think they really enjoyed it.

So also, another thing is that people are starting to also want to organize their own hunts, and this is great. I got my idea from Dr. Ken Fan, and now other students that attended my hunts are going to start making these satellite groups for other students. For example, just this morning one of the kids who came to my last hunt, who was one of the most inspired boys, he emailed me, saying that for his birthday party he wanted to make his own hunt for his friends. And I thought that this was a great idea, to spread this idea of collaboration and community from one person to another, so that everyone has a chance to really engage in mathematics and enjoy it, instead of just solving problems to get a score on a test. I think together, we're building a really nice mathematical community.

SL: Yes. I don't think anybody could agree more. Yes, I think there's something magic about what you're doing. So yeah, I don't have any words to add to that.

37:04 Okay, Mary. So, would you tell our listeners about a favorite experience of yours in a math circle?

MOK: Okay, so... I'm going to twist the question a little bit. My favorite experiences, actually, have not happened *in* a math circle. They have *grown out* of the math circle. I see the math circle

as something of an incubator. My all-time favorite--I mean, it's like, I hope this isn't irreverent or heretical, but if you think about religions, you know, there'll be a service on Sunday morning, or on Saturday, but what really matters is the difference it makes in people's lives, all week long, or outside, not just that one hour a week that people actually spend there--or, in our case, the three hours a week that people spend in our math circle on Friday nights.

So my all-time favorite experience associated with math circles is actually Gili's treasure hunt, because it's so much more incredible than anything I ever imagined possible, more incredible than anything that actually happens within our math circle. Our math circle is a wonderful community of students who love math, who come from families that really support their interest in math, you know, who already have a certain level of security about math, and who by and large are fairly privileged. It's a free program, it's open to everyone, but just the nature of who it attracts, it's not as broad as I would like it to be.

And Gili's treasure hunt, the first one that she ran last fall and then the others since then, they have broken down those walls. They have gotten kids working together who would not normally ever work with each other. As Gili mentioned, there are students that she's included that are part of the STEP program--Science [and] Technology Entry Program, that's a program at Union College for disadvantaged minority and socioeconomically disadvantaged students from Schenectady and nearby. And I've worked with those students, and Gili has helped me with those students and programs for those students. But Gili's treasure hunt has those students coming together with suburban students, whose parents have PhDs or professional degrees, who are scientists--and working as collaborative peers, you know, there aren't distinctions. They're just all working together to solve this set of problems. And it's just a beautiful, beautiful thing, magical thing, for me to watch.

And what's really magical is that Gili was the one who conceived the idea [of doing a local treasure hunt], who pushed the idea, who created everything... I mean, I just arranged the space and used my contacts to come up with some names of students to invite. But the way that she took ownership and just implemented one of my long-term dreams [of getting students from very different backgrounds to work together and become newfound friends] and that I hope will be built upon and expanded... that's the most amazing thing, that experience for me, out of the math circle.

And a related thing is, that, as I said early on, I originally thought, well, I wasn't competent to run a math circle. But I've told my story enough times that there are other people that have started, that have been inspired to, or by my message that you don't need to be divinely anointed to start a math circle. So there's a couple of young women in Ithaca, New York, where there wasn't a math circle, and they were high school students, and they said, "Well, we can start one." And they did! They started one, and it's entirely student-run, and they're in college now, but students that they worked with are continuing that work. So I find that incredibly rewarding, is realizing that our math circle, you know, we're sort of at the physical limits of who can actually fit into the room, but I love that it's able to scale by inspiring other math circles to imitate us. It would be wonderful if there

were professional mathematicians everywhere who could do the kinds of things that get done in the Boston Math Circle and the Bay Area Math Circle and the Berkeley Math Circle, but it's also exciting that people just are feeling empowered by our example to make it happen, even when those professionals don't exist.

SL: Yes, I hear your pride in just the idea that your successes ripple outward and continue to have effects beyond time and space, basically, from what you're doing in your little neck of the woods in Albany there. That's very cool.

42:54 Same question to you, Gili, and you are also welcome to twist the question, but tell our listeners about a favorite experience of yours in a math circle.

GR: Yeah, I've always loved coming to math circle and spending time with other people who are interested really in the same things as I am. I think that my favorite experience would probably be the treasure hunts also. I loved how I can really put something together and see it actually happen before my eyes, and have it run smoothly, have people enjoy it, and like I mentioned before, have people even want to create their own, be so happy with it that they want to create their own treasure hunts locally. And I really think that there's nothing that I personally did in math circle that is better than that.

I did, in 6th and 7th grade, I loved solving problems, and whenever I got one right, it really just made me happy. There is one problem in particular that--it was an AMC 10 problem, I believe?--I don't even remember what year it was from, and it was about a lune. And this problem, it had me compute the area of the lune. And really, it was one of those problems that looks easy, and then you take a look at it more and you can't solve it. So when I was in 7th grade, I think?, this was one of the problems that I still remember until now. I remember working on it for like 20 minutes and then finally being able to solve it, and it's actually come my way a couple times, and I think I put in on one of my treasure hunts because I liked it so much.

So when you actually get a problem yourself, the pride in it and the things you can learn from it is really tremendous.

SL: Very cool. Yes, I don't think I know how to compute the area of a lune (Gili laughs), so I'll have to think about and resist the hesitation to just let Google answer the question for me.

44:59 Okay, I've got another question for Mary. So Mary, when you're not teaching finance and not leading math circles, what other kinds of things do you like to do?

MOK: Well, I love the outdoors here. We're in an incredibly beautiful setting not too far from the Adirondacks and there's just a huge amount of nature, I really love, I live just half a mile away from a farm with cows. I love to be outside. There are beautiful parks. So we're just, we're in a little suburb between Albany and Schenectady, and we're just surrounded by a lot of natural beauty, you can see the mountains, and I love to be outside.

But I also love that we're right next door to Schenectady, which is a very troubled urban city but has some beautiful outdoor spaces, some beautiful parks that were created. And my thought, about a year ago, when I realized that we might never get students from the inner city just showing up on our Friday evening math circle meetings, I had this idea of bringing math circle to them.

So I conceived of this idea, I call it [guerrilla math circles](). And I will just take some simple materials, like sidewalk chalk or poker chips, and start doing math in interesting, in just sort of places where children already are, in these beautiful parks in the summers. When there's no school lunch for children, there are free lunches in the parks, so there are kids lined up, it's sort of a captive audience, and I'll just go and start doing math on a whiteboard or with chalk on the asphalt, just making, say, some sort of interesting beautiful geometric pattern, a tessellation--Pascal's triangle mod 2 is one of my favorite ones--and children will come up to me and they'll say, "So what are you doing?", and I don't tell them it's math. I just, depending on their level of sophistication and their age, I just explain it to them in terms they can understand and they're like, "Well, can I help? Can I be part of that?" and I say, "Sure!", and it's sort of like Tom Sawyer whitewashing the fence, and I draw whoever is there into doing it with me. And I just love being outside and surrounded by nature and just bringing, engaging with whoever comes along, and not necessarily restricting just to math, whatever people want to talk about. It's sort of my librarian dad coming out inside me.

SL: Oh, I love that, Mary. Even when you're not doing math, and you're out in nature and out with folks, you're doing math! (laughs)

MOK: Right. (laughs) Well, math is everywhere.

SL: That's great. I love it.

48:32 Okay, and last question is for Gili. So, I know you love to cycle, we'd love to hear more about that, plus any other activities that you enjoy beyond math, and then part B of that question is, when you go to college, do you think you'll major in math?

GR: Yeah, so, like Mary said, I also love the outdoors. And cycling, like math, has been something that I've loved since forever, like, I mentioned before that I used to work with my brother on math, but we used to also go out in the neighborhood and bike around for hours, and it was really so much fun. It was one of the things that I really enjoyed doing. And so I've actually been doing mountain bike races for the past five years, and before that I also did triathlons, and I love to run and play soccer.

So, actually, when I first came to a bike race--it was a mountain bike race, right--and I had a really unprofessional Wal-Mart bike, and I was only like eleven years old, and everyone who looked at me was like, "Wow, she'll never get up the mountain and finish the race!" But I actually

did finish that first race, and with persistence and determination, I was really able to finish the race! And since then, I've actually gone to many, many more races, and both me and my bike have improved.

SL: (laughs) So you've graduated from the Wal-Mart bike?

GR: I have graduated from the Wal-Mart bike, yes.

SL: So are these full triathlons that you're doing at some age younger than 16?

GR: Yeah. (laughs) I don't really do triathlons anymore, I used to when I was like 10 and 12. And now I mostly, I love biking, so I just, there are bike races, it's like a ten-mile loop, a mountain bike loop, so it takes a while, though.

SL: Wow, okay, I'm... what can I say, I'm impressed. Okay, and then part B of that question is, do you have any thoughts about whether you'll be majoring in math when you go to college or not?

GR: Yeah, so actually, from when I was younger I've always loved math, so I always thought I would major in math, and I was like, "Yes, I'm going to major in math." And actually, recently I discovered computer science, so I'm planning on either majoring in math or computer science, and those two are pretty tightly linked. So I'm not sure exactly what I'll do, but it'll be something that I'll definitely always take courses and I'll always continue to pursue mathematics because I really enjoy it.

SL: As someone who's studied mathematics and has been making a living in computer programming for the last thirty years, I think it's a dynamite combination, however the details of the degree and the coursework works out, to be really grounded in math and in computer science and in computer programming, it's just an amazing combination.

GR: Yeah.

MOK: I should say it's kind of cool for me, now that our math circle's been around for twelve years, to look at what our students are doing, and I mentioned before we have a couple of students, my daughter and Raju Krishnamoorthy, one of the other original students who is, they're both in Ph.D. programs in pure mathematics. But I would say we probably have more in computer science than in any--more of our alums go into computer science than any other single field. But it's cool to see the diversity. We definitely have students who are, we have a student who is in the Ph.D. program in English at Yale, he's a very, very talented creative-- [*audio cuts out*]

SL: You there, Mary?

MOK: --doing... What?

SL: Yeah, you got cut off a little bit.

MOK: Oh.

SL: So if you can repeat just the last sentence.

MOK: Okay, we have a student who is pursuing a Ph.D. at Yale in English, he's a very talented creative writer. We have another student who is pursuing, he wants to be an attorney working in poverty law, another one in law school working on reproductive rights, women's reproductive rights. We, just the range... we have another one who majored in music. So we have people who come through our math circle and are passionately doing many different things.

SL: Yes, also very cool. So, wondering if either of you have any final thoughts before we close this interview. Gili?

GR: No, just that I really want to continue to create these communities and keep working with people on the things I love like math and cycling, and just keep doing what I'm doing, because I really enjoy it.

SL: Yay!

MOK: Well, all I want to add is that I really... well, a couple things. One is I really have enjoyed listening to some of your older podcasts as I was preparing for today and have been thrilled to see how many people that I've long admired, that I've gotten to know better from listening to those podcasts. You really have an incredible collection here, so that's very cool, and I just want to say that I think it's great what you're doing and might have a few more suggestions (laughing) for more people to invite in the future.

SL: Would love more suggestions. Very good.

GR: Yeah, I just wanted to say thank you to Mary, because I couldn't have done any of this without her, and she really inspired me throughout the past five years that I've been a math circle student with her, and it's really been tremendous for me.

MOK: Well, I need to say thank you to Gili and to all the students who've made this experience what it's been. I mean, I have to tell you, back in 1994, when I first started hearing about math circles, and my older daughter, Alison, you know, she loved math, and her teachers knew that she was very good at math but they didn't quite know what to do with her, and so their idea of what to do with her was when the rest of the class was doing math, they sent her down the hall to a room all by herself where she had a computer drill program that if the rest of the class was doing, say, two-digit addition with regrouping, then the computer gave her problems with

(laughing) three-digit addition with regrouping, and it was a very isolating experience socially.

And I'm just incredibly grateful to all of the students who have contributed to making this community what it is, and also to our adult co-advisors, I've already mentioned Professor Krishnamoorthy, Mukkai Krishnamoorthy, who was there with me at the beginning, but also we have more advisors who have come on board, Bill Babbitt, Rita Biswas, and our newest, Alexandra Schmidt, a teacher at Hebrew Academy. It's just really wonderful, the people who've been willing to come together. It very much feels like stone soup. I mean, I literally did not know what I was doing that first night that our math circle met, and just the sustenance that I've gotten from the members of this community coming together and making it happen has just been amazing.

SL: Yes, makes me wish I lived in Albany. Yes, you have something really good going.

So I will leave the two of you and our listeners with this clever little problem from a blog called Futility Closet, which was then blogged by my friend Shecky at the Math Frolic blog, and the puzzle goes like this. And don't give away the answer, because we're going to let our listeners try to figure it out if they haven't seen this problem before.

If you take the digits 1 2 3 4 5 6 7 8 9, there are 362,880 ways that you can arrange those numbers to form a nine-digit number. Of those 362-plus thousand permutations, how many of them are prime?

MOK: Ooh.

SL: I will leave you all with that thought. So thank you again, Gili and Mary, there you have it, Inspired by Math!.