

# 2019 STEM Santa Fe

## Julia Robinson Mathematics Festival.®

Thursday November 7, 2019  
Santa Fe Indian School



## Summary Report

*STEM Santa Fe envisions a world filled with analytical citizens exploring complex issues for the betterment of society.*



# A BIG THANK YOU to our Festival Sponsors

## Diamond Sponsor



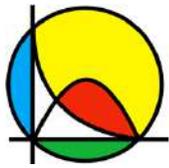
## Gold Sponsor



## Bronze Sponsor

SANTA FE  
COMMUNITY  
FOUNDATION





# Julia Robinson Mathematics Festival

## Introduction

**Julia Robinson**, a pioneer among American women in mathematics, was the first woman elected to the mathematical section of the National Academy of Sciences and the first woman to become president of the American Mathematical Society. She was a mathematics professor at UC Berkeley for many years and is especially known for her work in solving Hilbert's Tenth Problem.

**A Julia Robinson Mathematics Festival (JRMF)** offers students advanced and thought-provoking mathematics in a social and cooperative atmosphere. Students choose among several tables offering problem sets, games, or puzzles with mathematical themes. They work as long as they wish, while a facilitator provides support and encouragement. Motivation comes from the social interaction, rather than from any prize, grade, medal, or ranking. The festival can address any level of student, from those struggling with mathematics to those soaring in achievement. The Julia Robinson Mathematics Festivals began in the San Francisco Bay Area in 2007 and have since expanded throughout the country and the world!

**STEM Santa Fe Julia Robinson Mathematics Festival** is one of several STEM programs that is organized and led by STEM Santa Fe. STEM Santa Fe brought JRMF to New Mexico for the first time on February 24, 2017 and it was very well received. Since then STEM Santa Fe organizes this festival annually at Santa Fe Community College. This year STEM Santa Fe expanded the program with a second festival at Northern New Mexico College on May 17 specifically for Carlos F. Vigil Middle School in Española and this festival on November 7 , specifically for Santa Fe Indian School (SFIS) students.

**STEM Santa Fe Julia Robinson Mathematics Festival @ SFIS** was unique not only because it was all exclusively for Santa Fe Indian School (SFIS) students, but also because we trained SFIS high school students to be mentors and tables leaders. We spent two days prior to the festival date training about 90 high school students on how to run the math festival activities and how to be an effective mentor. The result was amazing. The high school students stepped up and were great at engaging with the middle school students to whom this festival was tailored.

The Julia Robinson Mathematics festival at Santa Fe Indian School took place in the Abeyta Gym at SFIS campus. Twenty-two colorful math activity centers were set up. The activities had challenges that ranged from being relatively easy to rather difficult. All activities had manipulatives and/or worksheets and students walked around freely and selected activities that might interest them. As the students explored and investigated, Table Leaders engaged, encouraged and guided the students to work through the activity problems under no pressure to find the correct answer, instead supported them to try different strategies and experience the joy of discovery.

## Student Mathematics Activities Descriptions

**Algebra on Squares** - Determine the length of the sides of each of the squares within a rectangle given the length of some sides.

**Color Triangle Challenge** - Try to find patterns that allow you to predict the colors that will appear in rows of dots.

**ConHex** - Think strategically and attempt to claim spaces to form an unbroken chain between opposite sides of the board.

**Cookie Monster** - How fast can the cookie monster eat all the cookies, if he must follow some simple rules?

**Criss Cross** – Play a game drawing a single straight-line segment joining any two points in a group of non-collinear points, without passing through any other points or segments.

**Difference Engine** - How long can a simple subtraction process be kept going before running out of interesting differences?

**Estimation Games** - Use simple calculations, and intuition, to estimate some unexpected quantities.

**Folding Fractals** - Fold a long strip of paper in half several times. Can you see a pattern in the creases formed along the length of the paper? What sorts of routes do we trace if we use the creases to direct our turns along a path?

**Hexaflexagons** - How can you fold a strip of paper into a shape that can be “flexed”, revealing several different faces than were visible at the start?

**Magic Squares** - Where is the magic number in a 3 x 3 grid?

**Mondrian’s Art Puzzle** – Release the inner artist to paint a canvas using colored rectangles. But there’s a catch: each rectangle must be a different color or size.

**Palindrome Grab** – A two-person game starting with a row of red and black checkers. Take a group of checkers from either the left or right end provided that they make a palindrome, the same backwards and forwards.

### **Pillage and Profit**

A twist on the game of Dots and Boxes – but instead of capturing as many squares as possible, we’re after gold doubloons!

### **Primes in Evenland**

In Evenland, the citizens never managed to invent the number one; instead, they started with 2, and built up sums and products from that starting point. What can we say about prime numbers in Evenland?

**Set** - Identify a *set* of 3 cards based on four features: Color, Number, Shade, and Shape, where all three cards in the *Set* are either all the same or all different for each feature.

**Skyscrapers** - Help the city planner decide where to build skyscrapers.

**Space Chips** - Cook up some polyhedra by following simple recipes. Invent new recipes, too!

**Star Polygons** - Under what conditions can you draw a star using all the vertices of a polygon, without lifting your pencil from the paper?

**Stomping on Dots** - Use specially shaped blocks to “stomp out” dots on a grid of squares. But if you stomp on a square without a dot, a new one appears! Can you stomp out all the dots?

**Switching Light Bulbs** - See the light? That is, can you see the patterns in light bulbs that are left on, after following a series of simple rules to switch them on and off?

**Tower of Hanoi** - Move a tower of 3-8 disks of different sizes, initially all stacked on one of three pegs to another peg following only two simple rules.

### **Wolves and Sheep**

How many sheep can you place on a field, so that none can be attacked by the simpleminded wolf?



## Festival Outcome by Numbers

**This 2019 JRMF @ SFIS was exclusively dedicated to Santa Fe Indian School students and organized by Lina Germann of STEM Santa Fe and Beth Cammarata of SFIS.**

93 High School students from Santa Fe Indian School were trained as Table leaders, but some had to miss the festival mainly due to UNM native day. **65 High School students participated as Table Leaders on the day of the math festival.**

**The festival was attended by 193 Middle School students (out of 206) and 11 High School students (other than the Table leaders).** In addition:

- 12 Middle School teachers and 3 high school teachers enjoyed the festival.
- 2 Mathematicians were present during the festival to support the Table Leaders: James Taylor and Belin Tsinnajinnie (a graduate from SFIS).
- 2 Volunteers helped at the festival: SFCC students: John Cammarata and Britney Davis
- 3 Table leaders Trainers: James Taylor, Robert Shankin, Lina Germann
- 22 unique math activities were available.

**Thank you all for all your help to make this festival a success.**

THANK YOU to SFIS Staff who welcomed us and a BIG Thank you to **Beth Cammarata** who invited STEM Santa Fe to hold the festival at SFIS and who went above and beyond to plan the best festival ever. Her dedication to her students and the school is admirable.

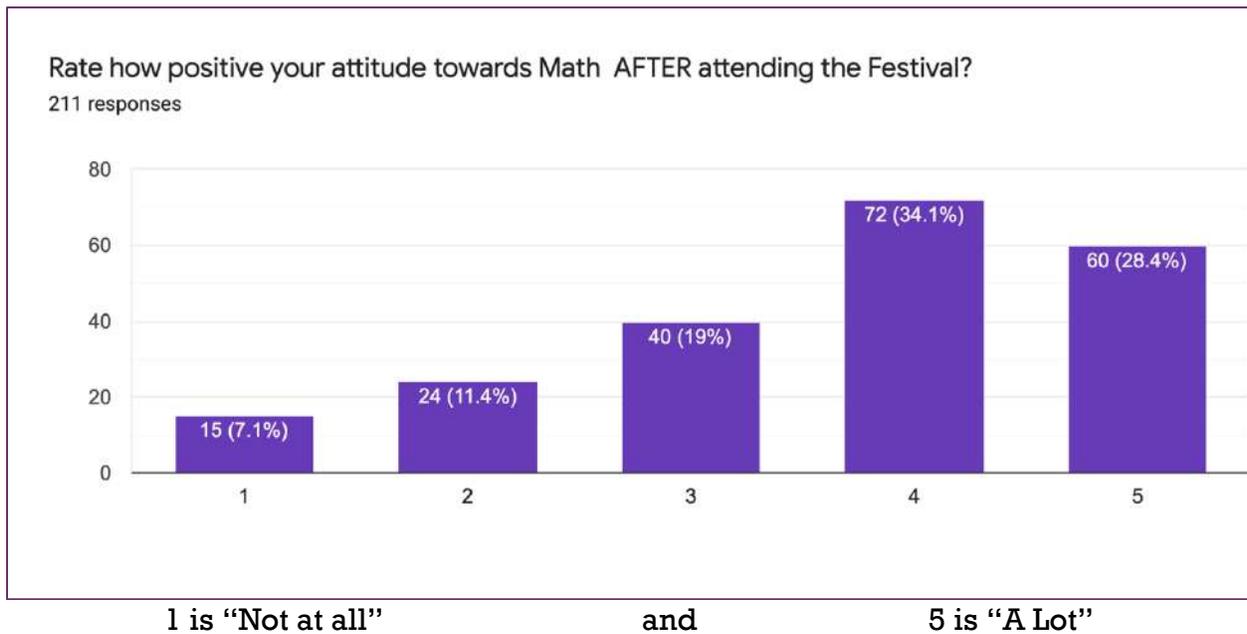
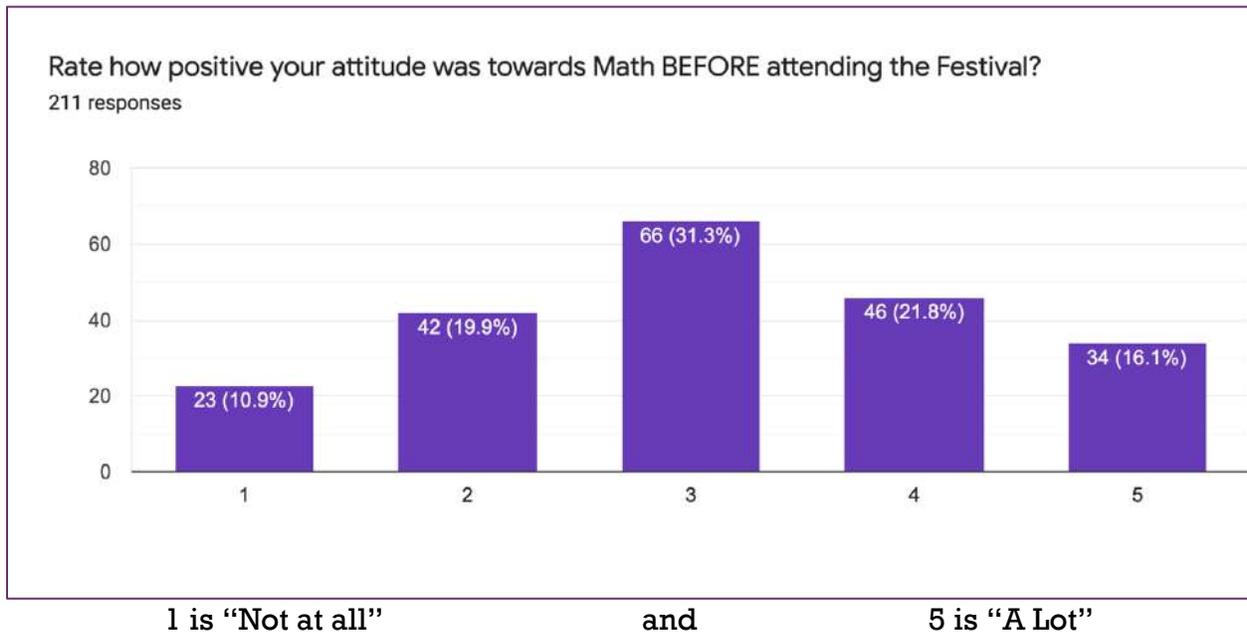
Thank you to James Taylor and Robert Shankin for leading the training for the Table Leaders. Thank you to our Photographers: Barb Odell and SFIS yearbook staff. Thank you, behind-the-scenes volunteer extraordinaire Katie Titus.





## Impact Measurement and Analysis

With the students' survey, we looked at how to measure the **Impact** of the Festival on the students.

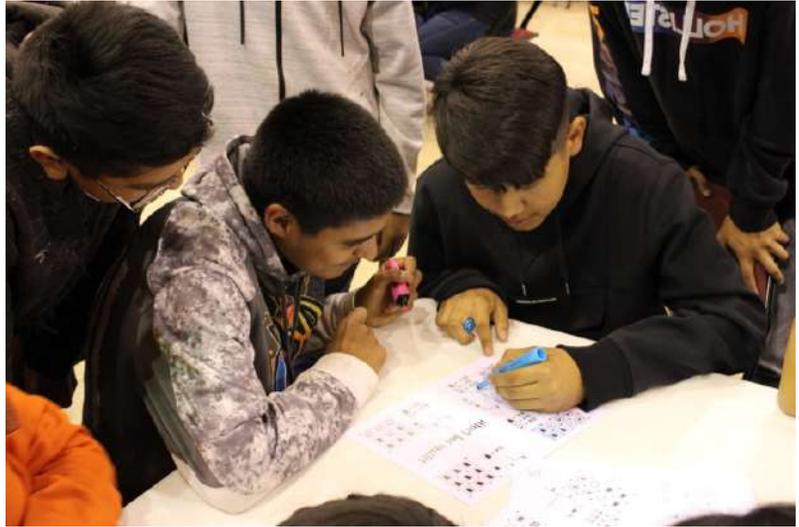


Attitude Rating	Negative (1 or 2)	Neutral (3)	Positive (4 or 5)
Before Festival	30.8%	31.3%	37.9%
After Festival	18.5%	19%	62.5%
Net Change (After-Before)	-12.3%	-12.3%	24.6%

This survey and the table above shows a positive shift in attitude towards math after the Festival. **We achieved an increase in positive attitudes toward math after the Festival of 25% in one day!**

## Quotes and Anecdotes from MS students

- *It was fun (most frequent answer)*
- *Please don't cut it short next time.*
- *not enough games and seats, lots of standing*
- *This festival was really good*
- *it was fun because i got to learn new thing 😊*
- *Making it more fun with more exciting people and include more algebra games.*
- *Maybe try and make the games more harder because they were kinda easy.*
- *It was awesome and cool hope we have other one ! :)*



- *It was a really great time and I like to thank you for your guys time.*
- *you guys did a good job*
- *I really wanted to finish the Towers of Hanoi but it was time to leave.*
- *it was fun and interesting*
- *i would like to have this at our school again*
- *I would like to add that i did not go to all of the activities.*
- *this was so fun we should keep on doing things like this .*
- *It was very fun and cool to play the math games and see our friends.*
- *It was fun and awesome I would like to go to the festival again.*
- *It was pretty cool to go to and i wouldn't mind going back to another.*



- *have more games or have more seating.*
- *I like how you have to connect the dots and make a square using an amount of numbers.*
- *stomping on the dots was a fun game tooooooooooooooooo!!!!!!!!!!!!!!!!!!!!!!*
- *Make some of the math more easier because some of it was hard*

## Teachers Surveys:

All the teachers that attended rated the festival at 4 or 5 on a scale of 1-5 where 1 is "Poor" and 5 is "Excellent". And 100% of the teachers indicated that they would definitely bring students again to this math festival.

**Survey Question: Did your students make any comments about the festival that surprised you?**

- *It was hard to solve, it was fun, let's do it again.*
- *Card games were the most fun*
- *It surprised me that they were talking about specific games and the challenges.*
- *Students said they were having a good time.*
- *Super energized before and after, definitely excited to do it again.*

**Survey Question: Anything else you'd like to share? Comments, suggestions, etc.?**

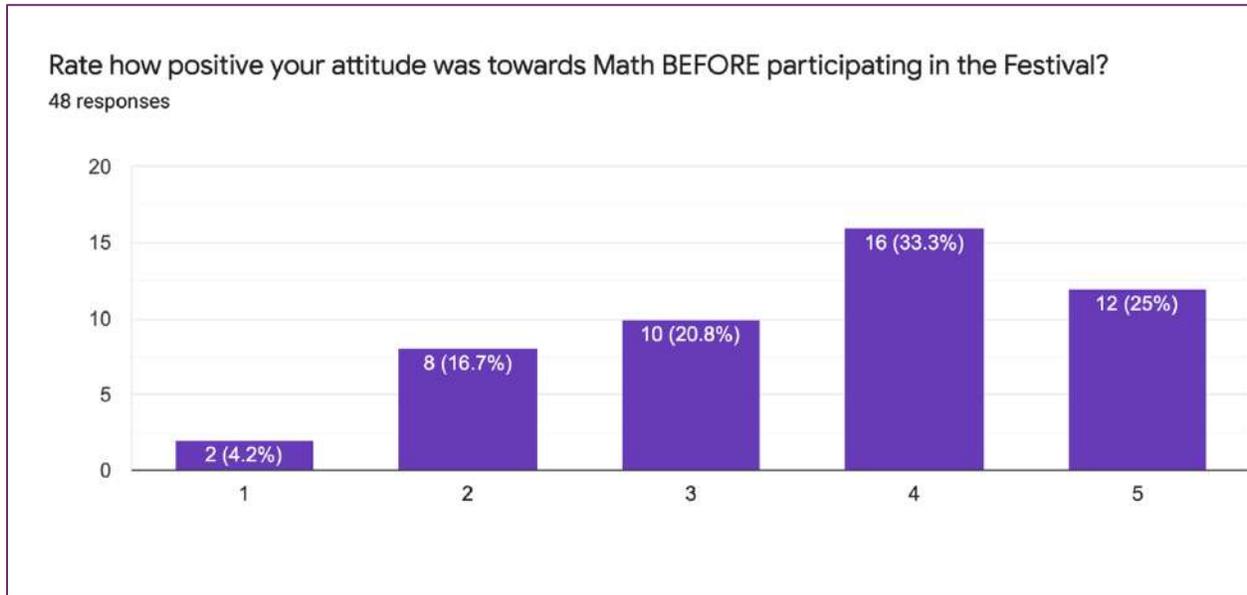
- *I participated in a few of the activities. HS students were patient, explained how to complete the math activity. Freebie and a T-shirt were nice compliments. Most students were interested and the event was well organized. Thank you, Manipulative's in math and in all other classes are needed for this generation.*
- *The students seemed to really enjoy it. It would be good if this were an annual event. Hopefully it will get kids more interested in math!*
- *I really enjoyed seeing former students mentoring our MS students.*

## HS Student Surveys:

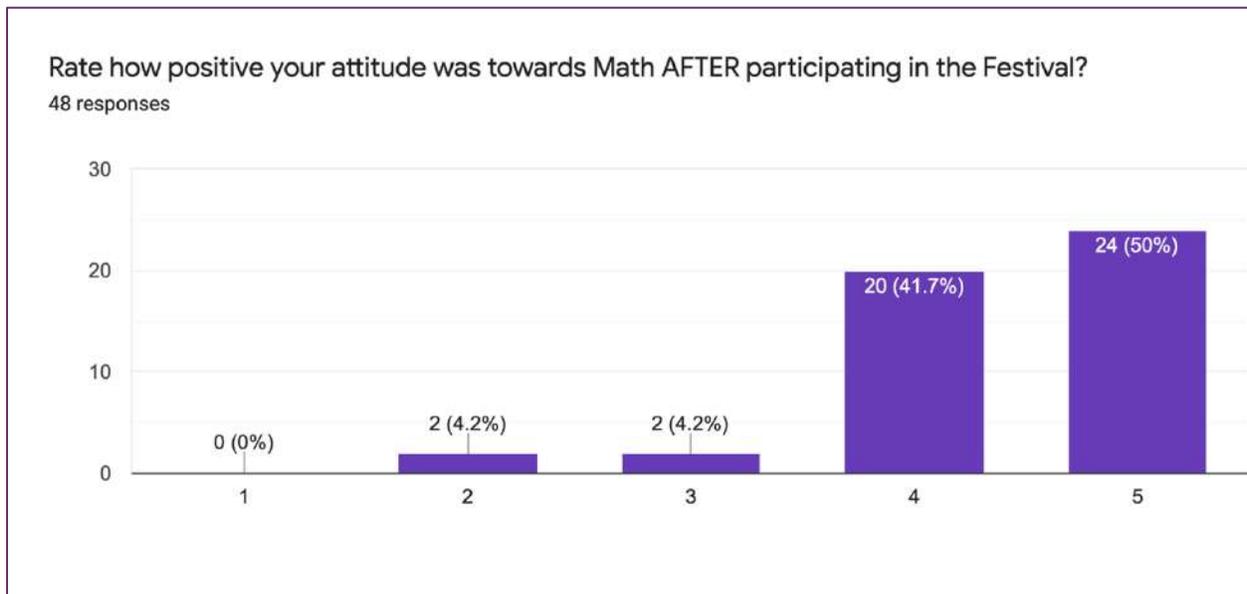
We also surveyed the high school students who served as table leaders and got some feedback: 48 responded to the survey even though 65 participated as Table Leaders.



Since the Table Leaders were high school students, we also measured impact:



1 is "Not at all" and 5 is "A Lot"



1 is "Not at all" and 5 is "A Lot"

Attitude Rating	Negative (1 or 2)	Neutral (3)	Positive (4 or 5)
Before Festival	20.9%	20.8%	58.3%
After Festival	4.2%	4.2%	91.7%
Net Change (After-Before)	-16.7%	-16.6%	33.4%

This survey and the table above shows a positive shift in attitude towards math after the Festival. **We achieved an increase in positive attitudes toward math after the Festival of 33.4%!** This is one data point but it is higher than the impact shift on the middle school students, which suggests that their attitude towards math shifted positively when they mentored younger students in math!

**Survey Question: Did the students at your table do or say anything that surprised you?**

- They helped each other and encouraged each other.
- they didn't know some addition, but that is okay!
- They did the activity in a short amount of time which was surprising.
- They were thinking outside the box as they built different polyhedron shapes
- They encouraged each other and helped each other.
- Just seeing their reaction and abilities to solve their puzzles, and seeing how they understood instructions.
- They tried more than once and they were also eager for more work.
- yes, they found more ways to figure out patterns than us
- They enjoyed the activity and thought it was fun.
- One of the students started talking about algorithms
- They actually worked the problems out
- I was surprised how interested they were with the game and how some of the middle schoolers kept coming back to our table bringing more people.
- Yeah, definitely they were engaged. I enjoyed it very much because there was a light in their eyes when they figured out the problems.
- one student was so interested in the activity that he finished 5 different puzzles while the rest only finished one or two
- They were trying their best but they really enjoyed the game

**Survey Question: Any other thoughts, comments, suggestions?**

- Multiple people trained at different activities to help other tables if needed.
- It was fun working with the Mid Schoolers.
- Maybe have more games
- I really loved that and want to do it again.
- It was fun, thank you :)
- I loved it, got to actually learn whilst teaching and likewise with the middle schoolers. Amazing activity, I visited with other tables before the event started to give them practice and I enjoyed that activity as well
- It was really fun and I appreciate the shirts that were made for us.
- It was an overall good experience for me as a High School student.
- I loved the math festival! It was a great opportunity for myself and the MS students.
- It was fun and exciting teaching the mid schoolers play.
- It was fun teaching, It was a great refresher and I love the idea of living in an alternate dimension where odd numbers do not exist! it was definitely fun wrapping my head around that concept.
- I had a blast and enjoyed the middle school students feedback towards the game.

## Summary and Reflections

The survey results and comments from students, teachers and volunteers after the Festival confirm that we achieved our goals of exposing students to the joy of mathematics and to inspire the teachers to take the activities back to their classes. Teachers who attended with their students were given each a gift bag with materials to run some of the activities they experienced at the Festival.

The unique goal of this specific festival was to train high school students to see themselves as mentors for the middle school students in a productive environment. For the most part, the high school students that participated proved to be excellent mentors and role models and 81% wanted to do it again for sure while 17% gave us a “maybe” response. The impact of the festival on the high school students was also significant with increase in positive attitude towards math of 33%.

This math festival produced a positive shift in attitude towards math in middle school students of 25%. Interestingly, we did this same analysis after this year’s JRMF at SFCC and there the increase in positive attitude was 33%. And at NNMC festival the shift was 49%.

This is STEM Santa Fe’s third math festival in 2019, and it was the first JMRF at Santa Fe Indian School. We are so encouraged by the excitement and engagement of students, that we aim to replicate this event again at SFIS and other schools.

**Thank you to all the sponsors and volunteers for  
inspiring the future generation in STEM!**

**STEM Santa Fe’s** mission is to advocate for, develop and provide STEM programming, mentoring and resources for all youth, especially under-represented groups in STEM, to realize their potential and expand their opportunities in a dynamic world.

STEM Santa Fe is a 501(c)(3) nonprofit charitable organization. More info at [www.STEMSantaFe.org](http://www.STEMSantaFe.org)

