

Mathworks

2017 Annual Report

Reaching Out Strengthening Within



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From the Director

Dear Friends,

Over the years, Mathworks has been guided by a focused mission: “To research and develop model programs and self-sustaining learning communities that engage K-12 students in doing mathematics at a high level.” Our commitment to excellence has enabled us to develop nationally recognized summer math camps, to build a model teacher training program, and to develop an innovative state-adopted middle school curriculum. Each of our three pillars –Math Camps, Teacher Training, and Curriculum Development – has had continued outstanding successes that are highlighted in the enclosed report.

None of this would have been possible without the wonderful support from the Mathworks Steering Committee, and a network of dedicated alumni, students, parents, and friends. The Mathworks family this year is pleased to welcome new partners including the Ron Brown Foundation that is helping to recruit and support African-American students. Together with Jeff and Gail Kodosky, Sarah and Ernest Butler, Herb Carter, the RGK Foundation, The Meadows Foundation, Silicon Labs, HEB Tournament of Champions, and many others, Mathworks has established several endowments and named scholarships to ensure that all students will be able to attend the Mathworks programs regardless of their financial circumstances.

Mathworks is now beginning to plan for our 30-year Mathworks Anniversary Celebration. We are planning events in April 2019 in conjunction with Math Awareness Month, and in the summer 2019 with our summer math camps. I hope you will be able to join us in these upcoming events, and would welcome your input and suggestions as we put these activities together. In particular, I would encourage all of our alumni to provide updates on what they are doing now at www.txstate.edu/mathworks/alumni-updates

Thanks again to everyone for your participation, ideas, and support for the past 28 years. We look forward to celebrating with you in the coming years ahead.

All best regards,



Max Warshauer
Director of Mathworks
Regents Professor of Mathematics

Mathworks 2017 Annual Report Reaching Out Strengthening Within

MISSION

Mathworks is a center for innovation in mathematics education at Texas State University. Our mission is to research and develop model programs and self-sustaining learning communities that engage K-12 students from all backgrounds in doing mathematics at a high level.

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Hiroko Warshauer, Research Coordinator
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Curriculum...

Weaving the Guiding Principles into Everything!

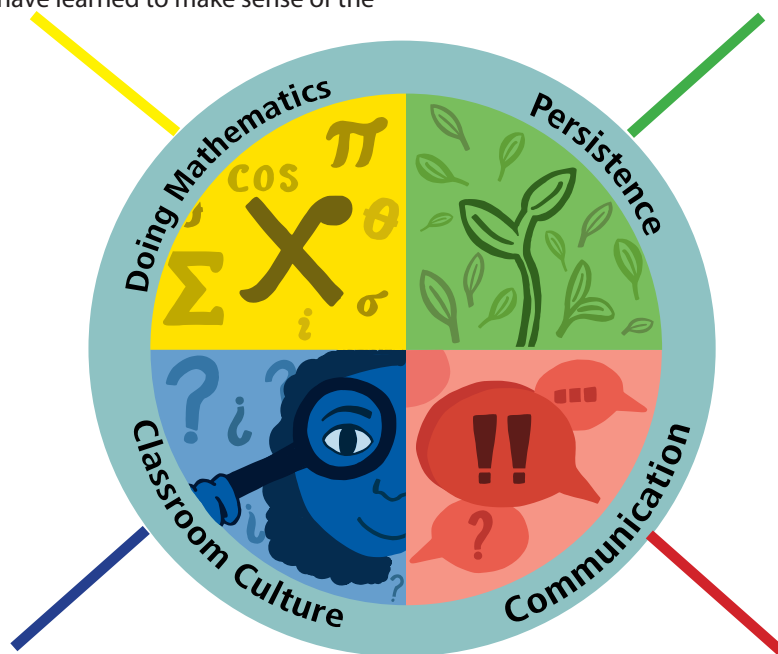
Research has shown that student success depends on an integrated approach that supports student learning in each of the domains below. At Mathworks, a center for innovation in mathematics education, our mission is to research and develop model programs and self-sustaining learning communities that engage students from all backgrounds in doing mathematics at a high level. For this reason, the Mathworks Guiding Principles are intentionally woven into every aspect of the Mathworks Program.

1. Doing mathematics is about making sense of and thinking deeply about fundamental concepts.

- Students should:
- “Think deeply of simple things,” (Arnold Ross)
 - Build on prior knowledge by making connections that follow the flow of ideas from what they previously understood to new ideas being studied
 - Promote a deep understanding for why things work using visual models
 - Focus on the math problems, not the answers
 - Reflect on what they have learned to make sense of the mathematics

2. Persistence is critical to success in problem solving and doing mathematics.

- Students need to:
- Develop a “growth mindset,” understand and believe that ability can be developed with hard work
 - Be willing to take risks and understand that mistakes present opportunities for learning
 - Take ownership of their own learning
 - Develop confidence to tackle new situations without giving up easily



3. Teachers need to establish a classroom culture that develops students' curiosity and imagination.

- The keys to establishing this culture are to:
- Make math interesting, fun and relevant with challenging, well-sequenced problems
 - Support student's productive struggle by responding to student questions with appropriate guidance
 - Allow sufficient time for learning ideas deeply
 - Use techniques to engage all students
 - Balance individual and group work; both can be appropriate depending on the task

4. Communication between students and teachers is critical for learning.

- To facilitate this, teachers should:
- Ask probing questions to develop student understanding, and encourage students to question why things work
 - Expect students to present their work and defend their reasoning using precise mathematical language
 - Take student attempts seriously, and examine both right and wrong approaches
 - Expect students to articulate and explain the key math concepts

Math Explorations Curriculum

Developed from 25 years of working with students to create fun, hands-on learning techniques to engage young students in using pre-algebraic and algebraic ideas, the **Math Explorations** curriculum full of in-depth problems that are well-sequenced and grounded with inquiry-based math activities.

Every page of the curriculum is full of interesting, challenging and fun math problems. When asked about the curriculum, this is what our teachers have to say:

"The curriculum is a great way to expose students to looking at mathematical ideas through explorations instead of examples. Algebraic concepts are woven throughout almost every section which really helps students feel comfortable when they do take Algebra."

"My students enjoy the problems because many questions are more thought-provoking than questions in a standard textbook and lend themselves to class discussions. These type of thought-provoking questions help students learn that not knowing an answer or making a mistake can lead them to greater understanding. The explorations also encourage group work and can easily differentiate within groups."



"Day one of O. Henry Math Camp and it could not be going any better! When I just left the three classrooms, students were practicing adding integers with the car model. They are really getting it!"

Who is using the Curriculum?

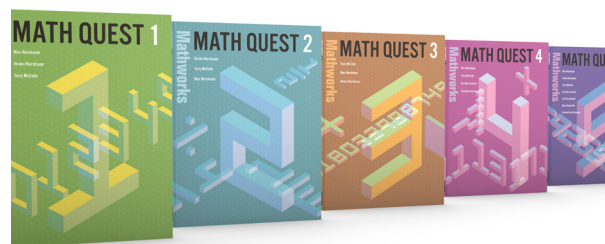
Kealing – Austin ISD
 Small – Austin ISD
 Coram Deo Academy
 Lake Travis STEM Academy
 Godley ISD
 Little Flower Private
 Idea Quest, McAllen



2017 Product Sales

Math Explorations Part 1	\$ 7,015
Math Explorations Part 2	\$18,100
Math Explorations Part 3	\$ 3,280
Total Sales	\$ 28,395

Camp-in-a-Box Featuring the Math Quest Curriculum



Two schools hosted summer math camps after attending the Professional Development Program at Mathworks.

- Idea Quest in McAllen had 45 students attend their math camp.
- O'Henry in Austin had 150 students attend their math camp.

Both schools used the Mathworks Camp-in-a-Box Curriculum, **Math Quest**, to provide their students with an exciting introduction to problem solving and preparation for algebra and higher-level mathematics.

Camps...

Honors Summer Math Camp

BY THE NUMBERS

262	Applied
68	Students Accepted
14	Research Projects
12	Colloquium Speakers

Over 60,000 hours of time was spent exploring math during the 28th Annual Honors Summer Math Camp.

Students from 18 states and Korea attended the program.



"Mathworks teaches its campers not to ask, "What?" but rather, "Why?" and "How?" I have learned not to just look at a theorem, accept it is true, and move on. Instead, I have learned to think critically about each step—why is this theorem true?"

-2017 HSMC Student

New Partnership with the Ron Brown Scholar Program

Mathworks was pleased to have nine students from the Ron Brown Scholar program attend the Honors Summer Math Camp.

The Ron Brown Scholar Program focuses on encouraging civic engagement among Scholars while promoting academic excellence, community and lifelong interactions. Recipients are young African Americans of outstanding promise who are offered academic scholarships, service opportunities and leadership experiences.

This partnership brings added diversity into the program and we are thrilled to partner with this outstanding organization.



"Being in an environment where everyone is genuinely just passionate about the subject is inspiring. This year, I was exposed to the world of research mathematics and really enjoyed my experience. Everything was so interesting, and my research mentor's passion was definitely very contagious."

-2017 Ron Brown Scholar

Colloquium Speakers

Guest speakers present a wide variety of topics that range in scope from creative writing to graph theory to special relativity. Colloquia give the high school students that attend the Honors Summer Math Camp the opportunity to hear talks by academic and industry leading professionals. Twelve topics were presented this year:

1. *Planar Graphs and Euler's Polyhedron Formula*, Ellen Robinson, Texas State
2. *Entrepreneurship and Building a Business*, Pat Oles, President, Oles and Associates
3. *Disease Detection in Social Networks*, Lauren Ancel Meyers, U. Texas
4. *Dido's isoperimetric problem*, Dan Shapiro, Ohio State
5. *Effective Thinking (and Euler Circuits)*, Mike Starbird, U. Texas
6. *The Challenges Ahead*, Admiral Bob Inman
7. *The Double Bubble Problem*, Frank Morgan
8. *The Life of an Author*, **Sandra Cisneros**
9. *Building a Business*, Bill Winters, Businessman
10. *Developing Business Plans and Entrepreneurship*, Jim Bell, Texas State Entrepreneurship Program
11. *What can Math tell us about a Stimulus Space*, Kaitlyn Phillipson, St. Edwards University
12. *Special Relativity, Newton and Einstein*, Steve McAdam, U. Texas



Research Projects

For the past 17 years, Mathworks has submitted research projects to Siemens, the nation's premier science research competition for high school students, to promote excellence by encouraging students to undertake individual and team research projects.

This summer, 2017, 14 research projects were conducted by the students and mentored by Texas State faculty. The research projects will be submitted to the Siemens competition on September 25th.

Best wishes to the teams as their work is judged in the nationally recognized Siemens research competition.

Four Teams from 2016 HSMC were Named Semifinalists in the Siemens Competition

- Junu Lee, Andrew Lu, and Sophia Sun, mentored by Eugene Curtin, for their project "Applications of Grassmann Algebra on Laplacian Matrices and Their Properties"
- Gina Chen, Vivian Liu, and Kyle Wang, mentored by Lucas Rusnak, for their project "A Generalization of Structural Degree of Imbalance and Complexity in Oriented Hypergraphs"
- Emily Chen, Surya Namboodiri, and Lillian Sun, mentored by Shuying Sun, for their project "DNA Co-Methylation Patterns in Cancerous and Normal Tissues"
- Julia Jia, Catherine Li, and Angela Zhang, mentored by Ziliang Zong, for their project "Exploring Energy Efficient Query Optimization Techniques for Databases Without Degrading Performance"

Junior Summer Math Camp - Residential

BY THE NUMBERS

120 Applied
45 Students Accepted
4 Students Selected for PMWC

An intense summer math program for middle school students who are excited about doing mathematics. The goal of the program is to develop young students into creative and critical thinkers and problem solvers. We nurture students' interests and abilities to pursue higher-level math courses and degrees and careers in science, technology, engineering and mathematics (STEM).

The 22nd Annual Residential program immerse 45 middle school students in doing high-level mathematics. These students get a taste of university life: living in Texas State University dormitories, eating at the university dining hall, and enjoying campus life.

During the week, students were in class from 8 am until the mid-day break for recreation and dinner, followed by study group in the evening until 9 pm. It's a full day that keeps the students engaged with others in their group who come from all over the US.

Weekend events include visiting The Meadows Center for Water and the Environment where research focuses on water and its relationship with the environment. The camp ends with everyone taking group photos wearing the camp t-shirt and sharing comments, notes, and jokes in the yearbook. Even if the t-shirt doesn't last a lifetime, the camp memories will and the yearbook will be a cherished memory from camp.

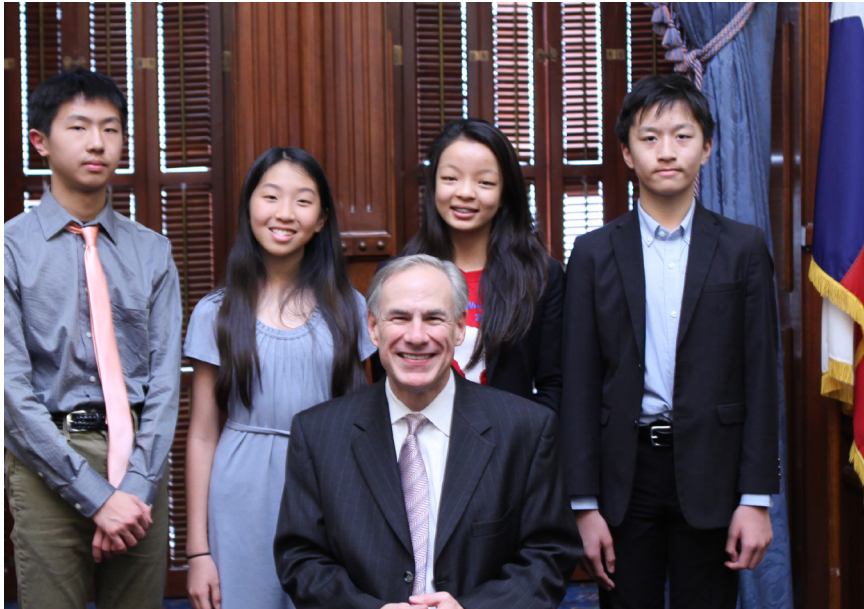
Mathworks Math Team Finishes First in International Math Competition

Every July, Mathworks sends a team of 4 Texas middle school students to Hong Kong, where they participate in the Primary Math World Contest (PMWC). The team is prepared for the competition at the Mathworks Junior Summer Math Camp by mathematics professor Jian Shen and counselor Daivid Xiang. This year's team won the PMWC Po Leung Kuk Cup for the eleventh time and placed 2nd Runner-Up overall. Congratulations to the 2017 team for their stellar accomplishments!



Front Row: Stephanie Wang, Rich Wang, Andrew Jiang, Isabella Quan
Back Row: Hiroko Warshauer, Team Leader; Dawn Blackwell, Deputy Team Leader

Governor Abbott Congratulates the 2017 PMWC Team



In July 2016, Texas Mathworks, a team of Texas middle school students under the tutelage of faculty from Texas State University and others, were among overall champions in the Po Leung Kuk 12th Primary Math World Contest in Hong Kong. The students, from Austin, Spring and Sugar Land, tied with teams from Hong Kong, Taiwan, Beijing, Indonesia and the Philippines. Texas Mathworks also won the Po Leung Kuk Cup, which is awarded to the top non-Asian team, for the eleventh time.

Front Row: Governor Gregg Abbott
Back Row: Pierce Lai, Amy Zhou, Michelle Wang, Andrew Cai

"Through both anecdotes and as a result of direct efforts on our part, there is meaningful advancement in math and STEM across the board in Texas," says the governor. "It's in our classrooms on a daily basis, and it's captured the imagination of our students. We're seeing some of the best and brightest young mathematicians in our schools right now."

-Governor Gregg Abbott

TX Middle School Math Team Dominates in World Competition. (2017, March). *Site Selection*. Retrieved from <https://siteselection.com/issues/2017/Mar/Cover.cfm>



"I can say with absolute confidence that this math camp has completely changed my life. I come from an area that has an extremely underdeveloped education system compared to other popular cities in Texas, and this camp changed my perspective on how I compare to people outside of my area. Nothing can compare to the quality time I have spent at this camp."

- second-year JSMC-R student, McAllen, TX

"[Mathworks] has helped me realize where I am, where I want to be, and how to keep growing in order to reach my full potential. My school district tends to hold people back from advancing too much, which is why I am so grateful to have been given this opportunity. JSMC and Mathworks have a special place in my heart, and I'm sad to be leaving so soon."

- third-year JSMC-R student, Kingwood, TX

"This has been an amazing experience, and I have made so many friends. Where I live, there aren't many opportunities for kids like me, who just want to get better at math. I have tried other programs, but they never really felt good because I had already learned most of the subject."

- second-year JSMC-R student, Edinburg, TX

"I want to overcome the stereotypes of my race and my background. I am Latina and I come from a shady neighborhood where not very many people succeed, but I want to be an example that anybody can overcome their background and stereotypes."

- second-year JSMC-R student, Donna, TX

Note: She wants to attend HSMC next summer and serve as a role model to other people in her community.

Junior Summer Math Camp

BY THE NUMBERS

169 Students Attended

Level 1: 3 Classes; 52 Students

Level 2: 2 Classes; 29 Students

Level 3: 3 Classes; 43 Students

Level 4: 1 Classes; 21 Students

Level 5: 2 Classes; 24 Students

22 Undergraduate Fellows

5 Teachers in Professional Development

19 School Districts represented
\$43,605 Scholarships awarded

This camp provides student enrichment in mathematics, undergraduate early field experience in teaching, graduate research opportunities and professional development opportunities for in-service teachers.



"I have really enjoyed being in this camp seeing how other people approach solving problems and the different perspective that others have. In this camp, there have been challenging problems that have forced me to think in different ways, contrary to the school experience which gives information first, then practice. This camp is different than other math experiences because we are given a problem first and have to come up on our own without the knowledge first. This has helped me learn how to do math in other ways and has helped broaden my horizons."

-2017 JSMC Student

Expanding Educational Opportunities for the Community

From a first-year program that introduces students to beginning concepts in algebra through play-acting and drama (dramathics), to a more advanced program in problem solving and discrete math, students enjoy exploring problems together and share in the excitement of mathematical exploration and discovery.

Thanks to the support of more than 17 foundations and corporations, and the generous gifts from individual donors, over half of the students that attend camp are given financial assistance. This support is critical to ensure that all students have an opportunity to attend, regardless of their financial situation.

For a complete list of our donors, please see the last page of this report.

"In math camp I learned about things that I didn't learn in school. It also made me think about how fun it would be to be a math teacher."

-2017 JSMC Student



Mathworks Fellows Earn Credit Assisting During Camp



This summer, with generous support from the Meadows Foundation, 22 Texas State undergraduate students from a variety of disciplines participated in the Mathworks Fellows Program. The Fellows assisted in the Junior Summer Math Camp (JSMC) classrooms and then spent the afternoon in professional development sessions, reflecting on and developing teaching skills and practices with teachers and Mathworks faculty. 8 Fellows also attended credited classes (Math 4302 and Math 4304) in conjunction with the JSMC camp experience. The professional development sessions integrated Mathworks Guiding Principles with math teaching practices from the morning math camp.

"(Students) can learn more from their wrong answers than right answers. Also, (when) give a good amount of time, students are able to think hard and long without the pressure of time."

-2017 Mathworks Fellow



"This program was the only time during my undergrad that I was able to learn pedagogy AND see it used effectively in field observations. It was critically important to my self-efficacy as a future math teacher. I got to see first hand the importance of ownership, productive struggle, classroom culture, and much more."

-2017 Mathworks Fellow

Read what the Fellows thought about the experience...

"The camp helped me learn more as a future teacher. I was able to take notes over what I observed from my master teacher. I learned different hands-on methods to teach different math topics. I learned so many different strategies that can be applied to just one math problem and others."

"Master teacher used questioning to draw information from the students. This pedagogical method of questioning was so important to solidify their understanding and it helped the students to learn from each other by seeing the mistakes others made and then being able to articulate why an answer was wrong and how to make it correct."

"I always leave camp feeling passionate about teaching. This camp has changed the type of teacher I want to be. I want to provide opportunities for students to make sense of what they are learning."

"Struggling and working through things is a part of math. We don't really remember the things that are super easy but we do remember the things that we struggle with and get through. Math isn't always about the answer, its about how you get there and usually there are lots of different ways to answer or even just think about a problem."

"I learned to promote hard work versus right answers."

Research & Publications

Graduate Student and Research Opportunities

Six graduate students (4 PhD students in Mathematics Education and 2 in the Masters of Mathematics program) worked with Mathworks faculty conducting research including gathering and analyzing data, teaching in the JSMC as well as Honors Seminar in the HSMC, and developing and writing up activities for publication to the NCTM journal, *Mathematics Teaching in the Middle Schools* (MTMS) Two manuscripts based on activities used in the 2016 JSMC have been accepted for publication by MTMS, coauthored with Mathworks faculty and 4 of our current and former graduate students (Robinson, Cui, Namakshi, Bhattacharyya, and Koehne). Two more manuscripts are currently under review based on activities used in the 2017 JSMC.

Several current and past PhD students are examining how programs such as the Mathworks Math Camps and Teacher Professional Development are enhancing practicing teachers, prospective teachers, and students in mathematics teaching and learning. Stay tuned as our graduate students contribute to the scholarly work in mathematics education.

"The training I received at Mathworks as a doctoral student was invaluable. The sheer diversity of experiences I had at Mathworks was extraordinary – teaching at math camp, participating in teacher professional development, publishing articles in peer-reviewed journals, co-authoring math camp workbooks, presenting at conferences, developing curriculum, working in aligning state standards to middle-school math texts (which were later state adopted!), data collection through classroom videos, data analysis and coding of the videos, and the list goes on! As a first-year faculty, I can now see how rare it is for any graduate student to get so many opportunities in different aspects of mathematics education (student learning, teacher education, informal math programs such as math camps, and curriculum development) from the very beginning of their doctoral studies. whereas Mathworks was providing me with field experiences where I could see how the theory and practice connected."

-Recent PhD Graduate

"Besides exposing graduate students to every aspect of mathematics education, Mathworks creates a very nurturing environment where everyone's ideas are valued."

-Current Doctoral Student



"Each year I have gained more research and teaching experience through the Mathworks program. I have also been able to co-author several articles, and research projects. By the end of my first year I was presenting research at an international conference. This experience, along with the other national conferences I helped present at, has made me much more comfortable presenting research and fielding questions from other researchers."

-Current Doctoral Student

Presentations by Faculty and Graduate students

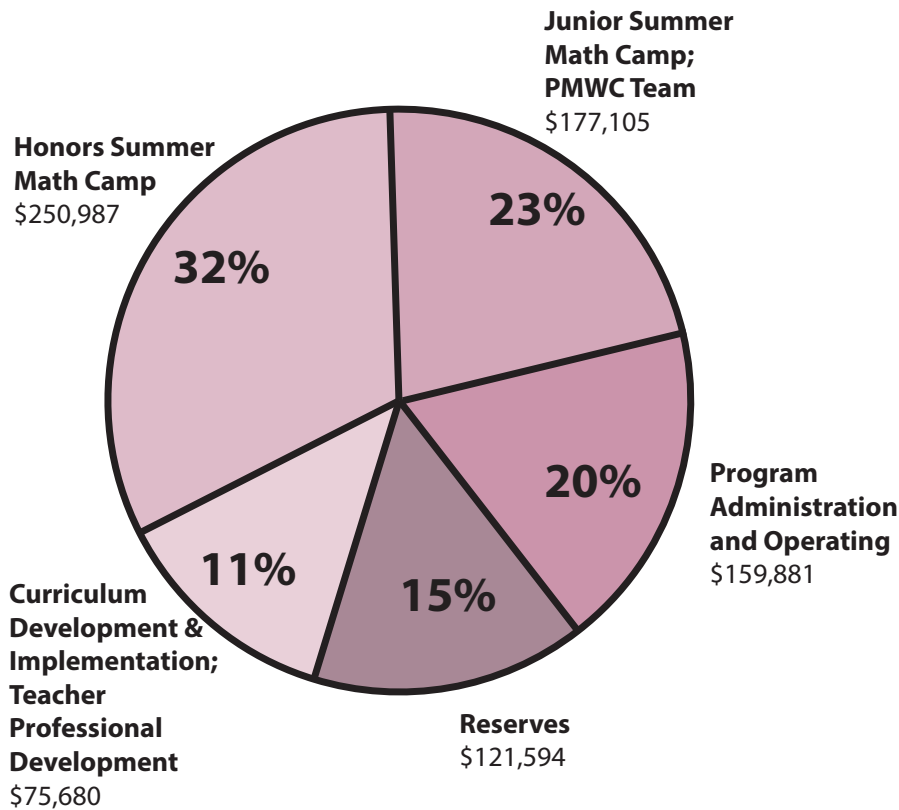
Beginning the 2017 year, Mathworks faculty Max Warshauer, Terry McCabe, and Hiroko Warshauer were invited to present a talk at the annual Joint Mathematics Meeting in Atlanta, GA. The talk entitled: *University and Public School Partnerships: Camps, Curriculum, and Teacher Training* was part of the American Mathematical Society's (AMS) special session on Public School Districts and Higher Education Mathematics Partnerships.



In February, Hiroko Warshauer was joined by former and present doctoral students, Christina Koehne, Sonalee Bhattacharyya, and Nama Namakshi at the Association of Mathematics Teacher Educators (AMTE) annual conference held in Orlando, FL. Their talk *Focusing Preservice Teachers Noticing Towards Productive Struggle* was based on work involving Mathworks Fellows who participated in JSMC.

Finances FY17

Total Operational Expenses: \$785,253



BY THE NUMBERS

- 68 HSMC Students
- 17 Counselors
- 15 Research Mentors
- 175 JSMCH Students
- 22 Undergraduate Fellows
- 5 Graduate Research Assistants
- 44 JSMCR Students
- 11 Counselors
- \$128,605 Scholarships Awarded
- \$4 million Mathworks Endowment

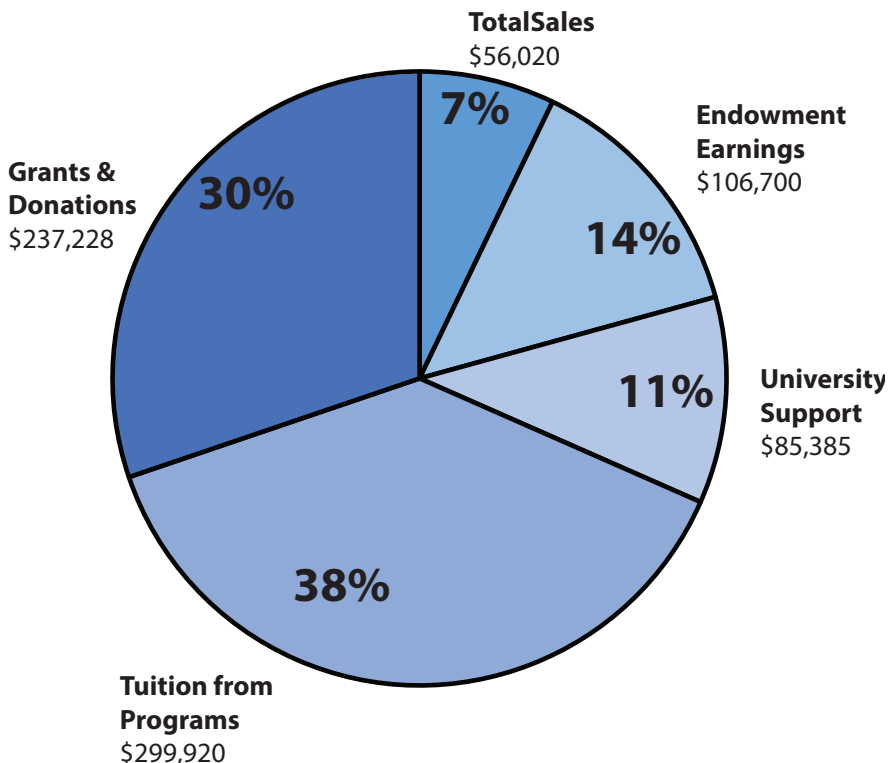
The Mathworks Endowment continued to grow thanks to our generous donors. The Mathworks Endowment ensures that students will always be able to attend our summer math camps regardless of their economic background. The goal of the Mathworks Legacy Campaign is to raise a \$6 million endowment to sustain all of our programs.

New Mathworks initiatives include:

- Supporting and Sustaining the Mathworks Fellows Program that provides undergraduates with an early introduction to teaching

- Providing Fellowships to graduate Research Assistants who work with Mathworks on curriculum development, teaching, and research about teaching and learning mathematics.

Total Operational Revenue: \$785,253



Our Partners

Individuals

Anonymous
Birdsong, Lance & Sharon
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Chen, Jenny
Ding Zhou
Chan, Wenyawn & Chuang, Alice
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Yachun, Peng & Charles
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Yuan, Shengli
Zielinski, Gary M

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RGK Foundation
Ron Brown Foundation Scholarship
San Marcos Lions Club
Silicon Labs

Our deepest thanks...

Mathworks is pleased to recognize donors who make it possible for us to provide high quality math education and programs to students from all socio-economic backgrounds.

Thanks to the passion and commitment of you and your fellow donors the fiscal year ended with \$237,228 in donations and grants.

Large or small, every gift you send directly benefits the students and teachers that attend these outstanding programs and furthers research in math education.

"Each year, ever since Level 1 I got a scholarship, I just decided to come back because it's fun and it might be a little challenging, but you learn so much each year."

-Math Quest 3, 2017 JSMC Student





Mathworks at Texas State University

Mathworks is a center for innovation in mathematics education at Texas State University. Our mission is to research and develop model programs and self-sustaining learning communities that engage K-12 students from all backgrounds in doing mathematics at a high level.

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