



*Photo Credit: Lily Jones*

What does it take to estimate pi? This is the question local high school students were challenged to solve in the first ever UC Merced Applied Mathematics Department High School Math Challenge.

The [High School Math Challenge](#) was a two week long event for local 9th - 12th grade students who wished to gain a deeper understanding of mathematics and get their first taste of conducting research. Working in teams of two, participants were given a problem that would push the boundaries of their mathematical knowledge. Under the guidance of a graduate student mentor, each team developed a creative solution to the challenge problem and created a research poster presenting their solution. For its inaugural year, the program had six participants, all from Atwater High School. Each team was asked to find a way to estimate pi and explore how their estimation effects calculating the area of a circle. For many participants, this was their first time applying their mathematics skills to a real world problem. When asked about her experience in the program, Atwater High School sophomore and High School Math Challenge participant Miah Ward said "The Applied Math Challenge was a fantastic opportunity for us, students, to utilize our knowledge in mathematics and computer science and apply it to a real-world situation. Alongside the guidance of our graduate mentor, we were able to think outside the box and approach the situation from multiple directions."

Applied mathematics PhD candidate and High School Math Challenge organizer and mentor Jared Stewart was the visionary behind this year's math problem. When asked about his inspiration, Stewart said "Over the past few years, in collaboration with the UC Merced SIAM Student Chapter, I worked on similar challenges targeting senior undergraduate students. Reflecting on these experiences, I decided to target high school students, who are farther up the education pipeline. The idea of pipes got me thinking of geometry and the areas of circles. Naturally the root of all those endeavors lead to pi. Thus, the challenge to estimate pi was born."

The program opened with a day long orientation at Atwater High School and culminated in a day at UC Merced where students took part in a campus tour, attended the Summer Undergraduate Research Institute (SURI) end of summer research symposium, and presented their work in a mini poster session. For most, this was their first experience making and presenting a scientific poster. Applied mathematics Professor and High School Math Challenge co-organizer Changho Kim was one of the poster session attendees. "During the event, I visited each poster", Kim said. "Each team explained their approach clearly and confidently and answered my questions very well. I was very impressed by the quality of their posters and their attitude and confidence."

Also among the poster session attendees was Lily Jones, teacher at Atwater High School and strong supporter of the High School Mathematics Challenge. "Having my students participate in the UC Merced Applied Math Challenge has enriched their learning experience" said Jones. "They were able to build a connection with their mentor and tackle an open-ended math problem that yielded a variety of methods. I was most impressed by their speaking abilities to express their solution. I would highly recommend the endeavor to any student."

As the first in her family to attend college, Professor Petra, one of the co-organizers of this event and faculty advisor of the UC Merced SIAM Student Chapter, understands the importance of outreach to high school students, especially those who lack exposure to the many career options available in mathematics. In 2017 Petra [received a Faculty Early Career Development Program \(CAREER\)](#) from the [National Science Foundation](#). "Applying for the NSF CAREER award motivated me to think about concrete and long term research and education plans," Petra said. "One of the educational activities I proposed was to develop summer mathematics workshops for would-be first-generation college students and those from underrepresented groups." I am so glad we were able to make one of these goals a reality. Shayna and Jarred were terrific ambassadors for the Applied Mathematics department, and did an amazing job leading this outreach event. I am hopeful that this successful event will be only the beginning of a wonderful collaboration between UC Merced Applied Mathematics and local High Schools.

Inspiration for the High School Mathematics Challenge came from the annual UC Merced [SIAM Student Chapter Applied Math Challenge](#), where undergraduates from across UC Merced put their math skills to the test to solve real world problems with the help of graduate student mentors. For the high school students, the goal was a little different. Stewart says "My personal goal was to expose my students to computer programming--a valuable aid in research and technical work."

This program was made possible because of the dedicated work by organizers Professors Noemi Petra, Changho Kim, and Lei Yue, and graduate students Jared Stewart, and Shayna Bennett. The organizers would like to thank PhD candidate Maia Powell for creating the High School Mathematics Challenge flyer and logo and PhD candidate Majerle Reeves for mentoring the challenge participants. We are grateful to Lily Jones and Atwater High School for their support and space for the High School Math Challenge orientation. Last but not least, the organizers would like to thank the Undergraduate Research Opportunities Center (UROC) at UC Merced for their invitation to visit and participate in the SURF events. This event was funded by the National Science Foundation, under Professor Petra's CAREER grant DMS-1654311.

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