

Mathematical Profile Cards



Dear educator,

When we tell stories that are inclusive of gender, race, culture, and socio-economic backgrounds, we give the opportunity for all students to identify themselves with the learning and exploration of mathematics.

At Amplify, our curriculum weaves the thematic development of mathematics together with rich and poignant stories to inspire a lifelong curiosity for the subject. These mathematical profile cards are emblematic of the passion of the Amplify team to humanize math, and to give students the most colorful illumination of the subject.

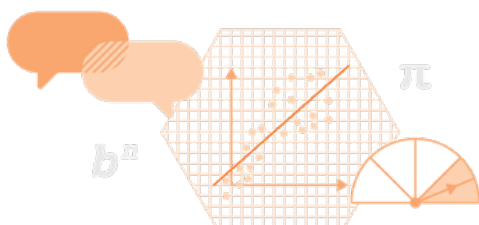
This is just a taste of what Amplify Math offers teachers and students. We hope you and your students enjoy learning about the diverse individuals who have shaped mathematics and check back in with us, when you're ready, to see everything Amplify Math has to offer.



Sunil Singh
Amplify Math consultant

Directions:

Each profile card highlights the life and accomplishments of a mathematician. Give each student(s) a card and have them read the profile. After completing their reading, students should find the two individuals who match the clues on their profile card.



Joan Clarke



Joan Clarke (1917–1996)

Joan Clarke, was best known for her work as a codebreaker at Bletchley Park during World War II. Bletchley Park served as the home of the British Government Code and Cypher School (GC&CS). There Clarke served as the only woman to work on the Enigma Project. The project decrypted Nazi Germany's secret communications and is credited with ending WWII years earlier than it might have. Her work is depicted in the Oscar-nominated movie "The Imitation Game," in which she is portrayed by Keira Knightley.

Clarke continued her mathematical work after the war. Ten years after the war, she returned to the GC&CS, where she remained until 1977. During her retirement Clarke assisted with research and publications on the work done at Bletchley Park.

Due to the confidential nature of the work done at Bletchley, the full extent of her work is unknown.

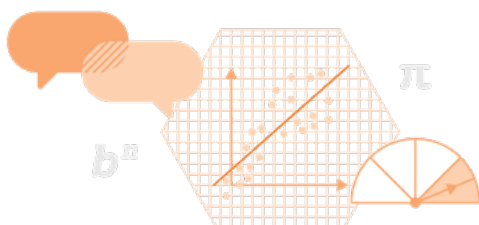
Now that you know more about Joan Clarke, find individuals who meet the following descriptions:



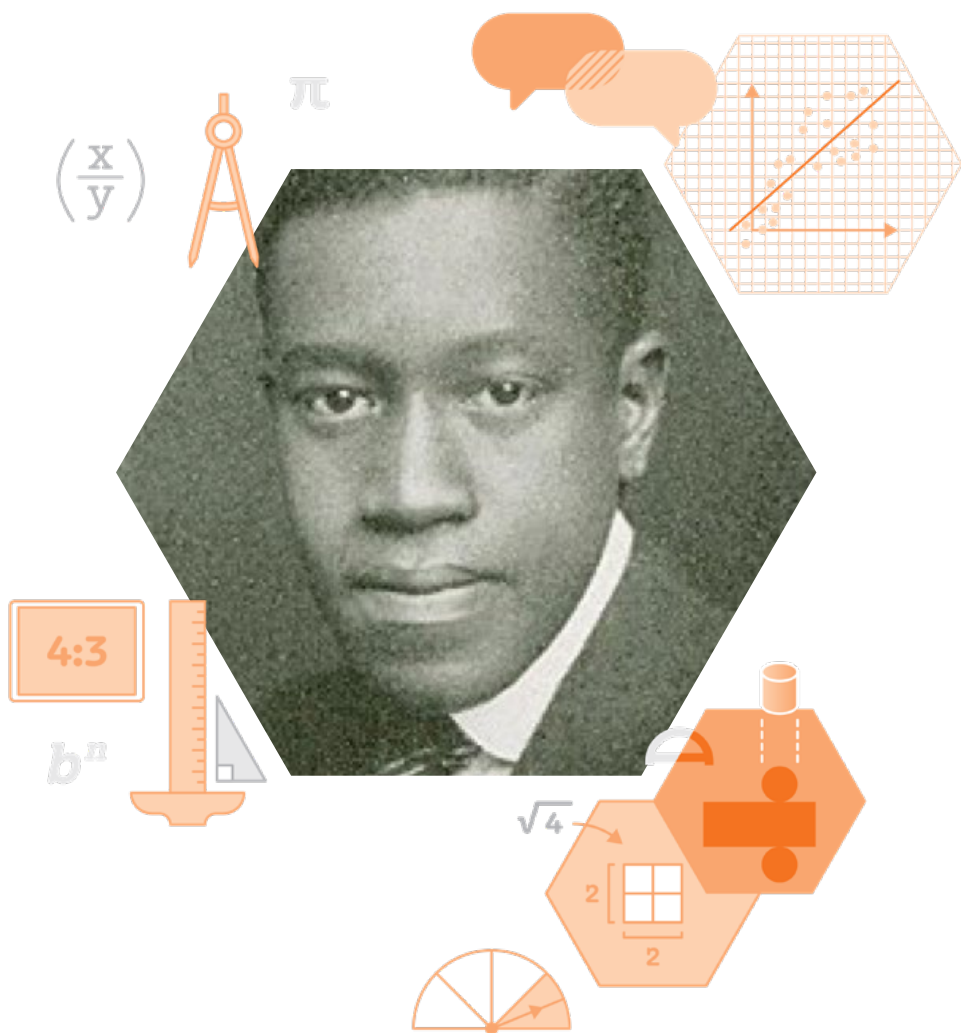
This individual was awarded a Ph.D. in mathematics at age 22.



Unable to find a publisher for their work in the 1930s due to racism, this individual sent their work to many countries for publication. Their work was eventually published, finally succeeding in Japan.



Elbert Frank Cox



Elbert Frank Cox (1895–1969)

Elbert Frank Cox was the first African American to receive a Ph.D. in mathematics. Born in Evansville, Indiana, on December 5, 1919, Cox served in World War I. After the war he began his career as a high school math tutor. In 1921 he applied to the Ph.D. program at Cornell. Post-doctorate, he began teaching at West Virginia State College where he greatly influenced the math curriculum.

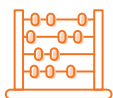
In 1929 he joined the faculty at Howard University. Cox attempted to publish his work but faced rejection as an African American. His work was eventually published in 1934 in Japan's Tohoku Mathematical Journal.

Cox is credited during his tenure with advising more master's degree students at Howard than any other professor. In 1954 he became the head of the mathematics department.

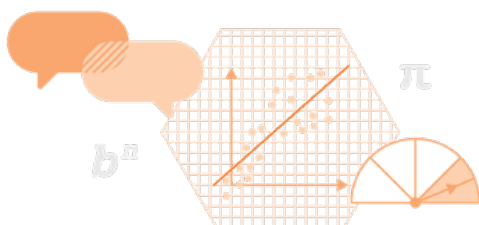
Now that you know more about Elbert Frank Cox, find individuals who meet the following descriptions:



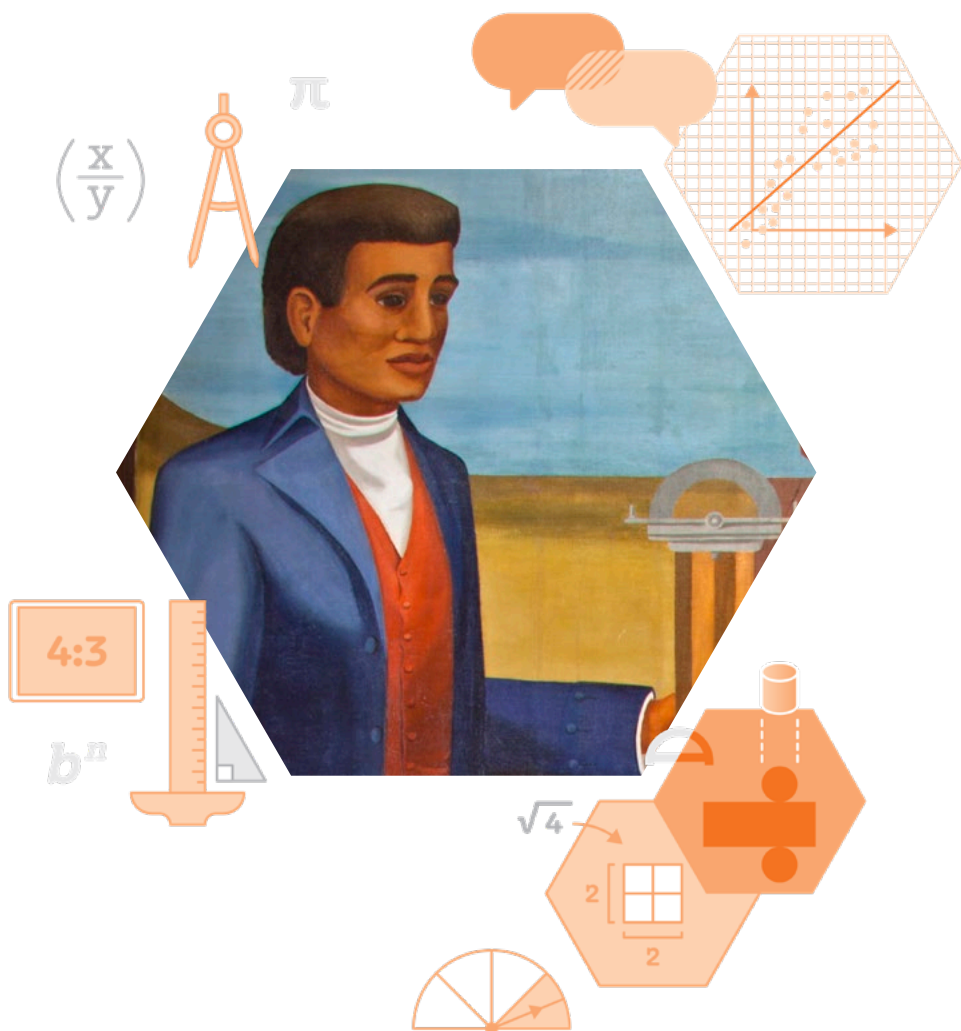
This individual was a codebreaker at Bletchley Park during WWII and was the only female on the Enigma Project.



This individual's childhood in Burma (present day Myanmar) exposed mathematics for them and the belief that math is everywhere.



Benjamin Banneker



Benjamin Banneker (1731–1806)

Benjamin Banneker was born in Baltimore County, Maryland to a free black mother and a freed slave father. Primarily self-taught, Banneker developed an interest in astronomy. Initially, racism prevented publishers from buying and publishing his work. However, in that same year surveyor Major Andrew Ellicott hired Banneker to assist in the initial land survey for what would become the current layout of Washington, D.C.

When that role came to an end, Banneker continued to pursue astronomy. His research included predicting eclipses and planetary conjunctions for 1792. Banneker's writing was eventually published after Ellicott passed it along to an abolition group president. Banneker's initial work led to the first of a six-year almanac for the Chesapeake Bay region.

In 1791, Banneker boldly wrote a public letter to Thomas Jefferson citing Jefferson's own words in the Declaration of Independence, along with language from the Bill of Rights, to expose the contradictions between the stated ideals of liberty and equality and the continued practice of slavery (even by Jefferson himself). Jefferson responded politely, but without commitment to change or action. Banneker's letter continued to circulate, however, and ultimately helped influence public opinion in favor of abolition.

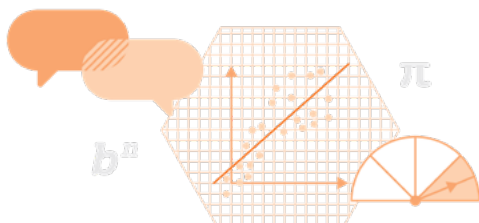
Now that you know more about Benjamin Banneker, find individuals who meet the following descriptions:



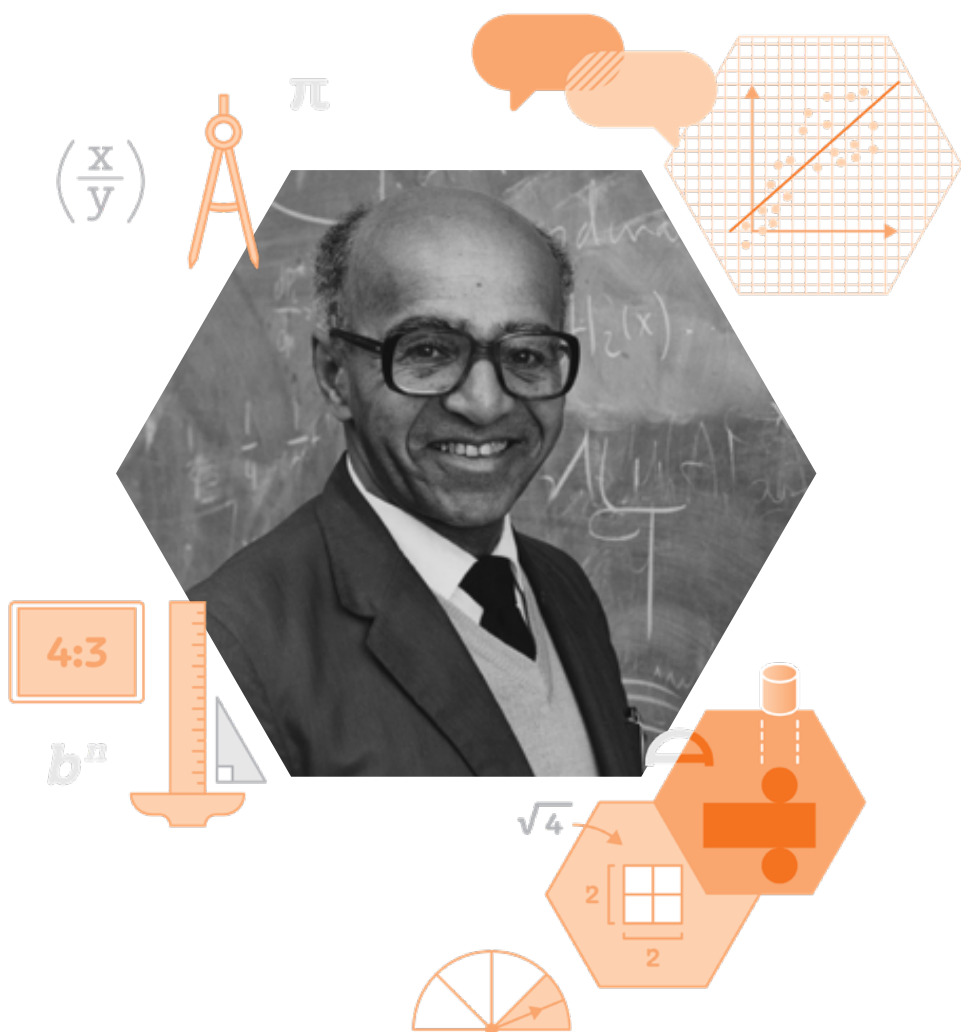
Keira Knightley received an Oscar nomination for her portrayal of this person. However, this code expert's contributions may never be fully known due to laws regarding classified British WWII documents.



Their work as a computer programmer was so essential to the United States military, they were recalled from retirement and served an additional 20 years on active duty.



David Blackwell



David Blackwell (1919–2010)

Born in Illinois, David Blackwell graduated high school when he was just 16. He got his Ph.D. in mathematics at the University of Illinois at the young age of 22. Blackwell was African American, and racist objections to his employment prevented him from attaining positions at many universities. Finally, after working at three historically black colleges, Blackwell took a position at University of California, Berkeley—one of the colleges that had rejected him more than 10 years earlier.

Blackwell's work as a statistician contributed significantly to game theory, information theory, and statistics. He was the first African American to be inducted into the National Academy of Sciences, the first black tenured faculty member at UC Berkeley, and the seventh African American to receive a Ph.D. in mathematics.

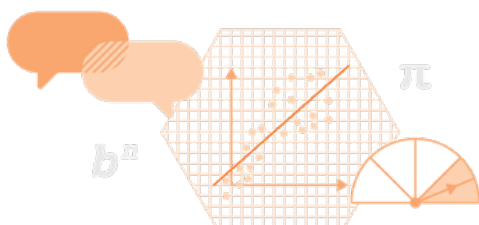
Now that you know more about David Blackwell, find individuals who meet the following descriptions:



This individual was the first African American to receive a Ph.D. in mathematics.



This person was on the surveying team whose work led to the current layout of Washington, D.C.



Sophie Germain



Sophie Germain (1776–1831)

Marie-Sophie Germain was born on April 1, 1776, in Paris, France. The French Revolution began when Sophie was 13, which forced her family to stay at home. Looking for a source of entertainment, Sophie began reading the books in her father's library. Her journey with math began after discovering the story of Archimedes. Sophie was fascinated by how Archimedes became so engrossed in a math problem that he neglected his own safety and was killed by a soldier of Syracuse. Sophie's parents disapproved of her interest in mathematics due to the norms of the time, which held that math was a man's work. Sophie persisted and read at night, even when her father took her blankets and lamp. Eventually, her parents relented and allowed Sophie to teach herself math, including college-level calculus.

In 1794, the École Polytechnique (a higher-education institute) opened in Paris, allowing students to obtain lecture notes and share solutions without attending. The school barred women from participating, but Sophie was able to participate using the name of a former student, Monsieur Le Blanc. Her mathematical studies continued throughout her life, though she always faced prejudice due to her sex. Despite becoming the first woman to win the prestigious Paris Academy of Sciences Prize, she was not allowed to attend its sessions because she was a woman. Unable to find a career as a mathematician, Sophie independently published her work and worked until she died of breast cancer at age 55. Even with all her accomplishments, she was not recognized as a mathematician on her death certificate—her occupation was listed as “property holder.”

Today, the Academy of Sciences awards the Sophie Germain Prize annually.

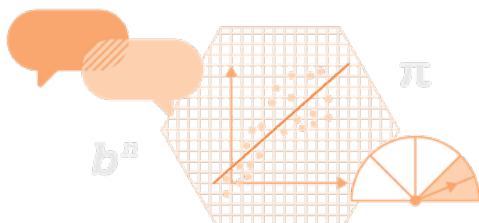
Now that you know more about Sophie Germain, find individuals who meet the following descriptions:



This individual is an ethnomathematician.



This individual coined the term “bug” for a computer malfunction.



Grace Hopper



Grace Hopper (1906–1992)

From an early age, Rear Admiral Grace Hopper was interested in how things worked. Her fascination led to an eventual Ph.D. in mathematics from Yale. After teaching math at Vassar, Hopper tried to enlist in the Navy during World War II but was rejected for a number of reasons, including the belief that her teaching job was considered essential to the war effort. In 1943 Hopper took a leave of absence from Vassar and joined the United States Navy Reserve. Graduating first in her class, Hopper began work on computer programming.

After WWII, Hopper began work at Eckert–Mauchly Computer Corporation, where she proposed writing a new programming language using only English words—an idea so revolutionary it was rejected for three years. Hopper continued as a Navy reservist, where she developed pioneering computer technology for the Defense Department. There, she made perhaps her most commonly known and used contribution to the field: she coined the term “bug” for unexplained programming glitches and failures.

After retiring in 1966, Hopper was recalled the next year to active duty in order to standardize the U.S. Navy’s computer languages. When she retired in 1986 at the age of 79, she was the oldest officer on active U.S. naval duty.

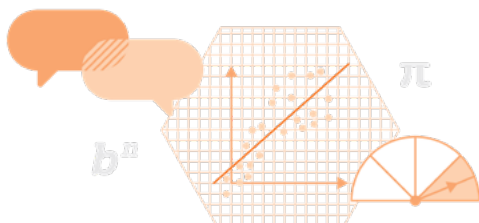
Now that you know more about Grace Hopper, find individuals who meet the following descriptions:



After a personal setback, this individual eventually found work at NASA, becoming one of the first African American computer scientists.

$$E=mc^2$$

This mathematician furthered Einstein's work.



Emmy Noether



Emmy Noether (1882–1935)

Emmy Noether was born in 1882 to a German Jewish family. She planned for many years to teach French and English. However, she changed her mind and began studies at the University of Erlangen after the university announced it would allow women to attend. Still, only one of two women enrolled, Noether could not participate fully in classes and did not receive a grade for her work. Additionally, she required the permission of individual professors to attend lectures.

Following her father's lead, she turned to mathematics. However, Noether continued to face discrimination due to her sex. For seven years she worked without pay at the Mathematical Institute of Erlangen, filling in for her father when needed. When she was invited to lecture at the University of Göttingen, other colleagues opposed her hiring. Despite this sexism she faced, Noether continued in her work and was influential in both mathematics and physics. Her work brought her fame, and influenced Einstein's theories and contributions to abstract algebra.

Noether continued lecturing in Germany until the Nazi government removed Jews from university positions. Noether eventually took a position at Bryn Mawr College in the United States. But only two years later, she died suddenly from an illness that doctors never fully understood. Her ashes were placed under the walkway of the Bryn Mawr library.

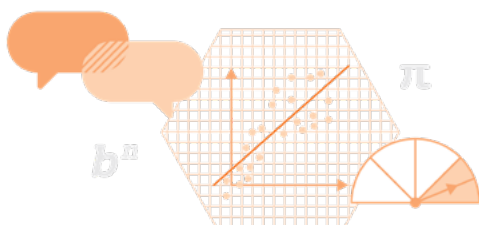
Now that you know more about Emmy Noether, find individuals who meet the following descriptions:



This individual's work laid the foundation for space shuttles.



This individual co-founded the Science in Australia Gender Equity program.



Jama Musse Jama



Jama Musse Jama

Jama Musse Jama was born in Somalia in 1967. Fluent in Italian, Jama completed his postgraduate education in Italy, where he received a Ph.D. in computational linguistics.

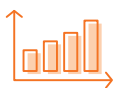
Jama is a prominent ethnomathematician, studying the relationship between mathematics and culture. His most notable research focuses on traditional Somali board games, including Shax, which is played to this day. He also has a particular interest in civil liberties and has authored or co-authored six books on these topics.

Jama has also researched the history of mathematics in the Horn of Africa and works as an activist in Somalia promoting literacy. He is the founder of the Hargeisa International Book Fair, one of the largest public book fairs in the Horn of Africa. The fair promotes translating literature to Somali, along with publishing Somali literature.

Now that you know more about Jama Musse Jama, find individuals who meet the following descriptions:

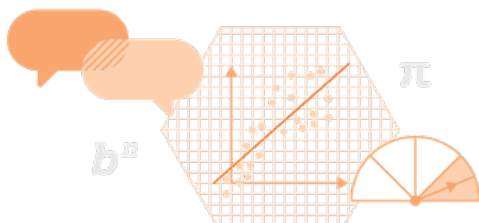


Their mathematical journey began with the outbreak of the French Revolution.

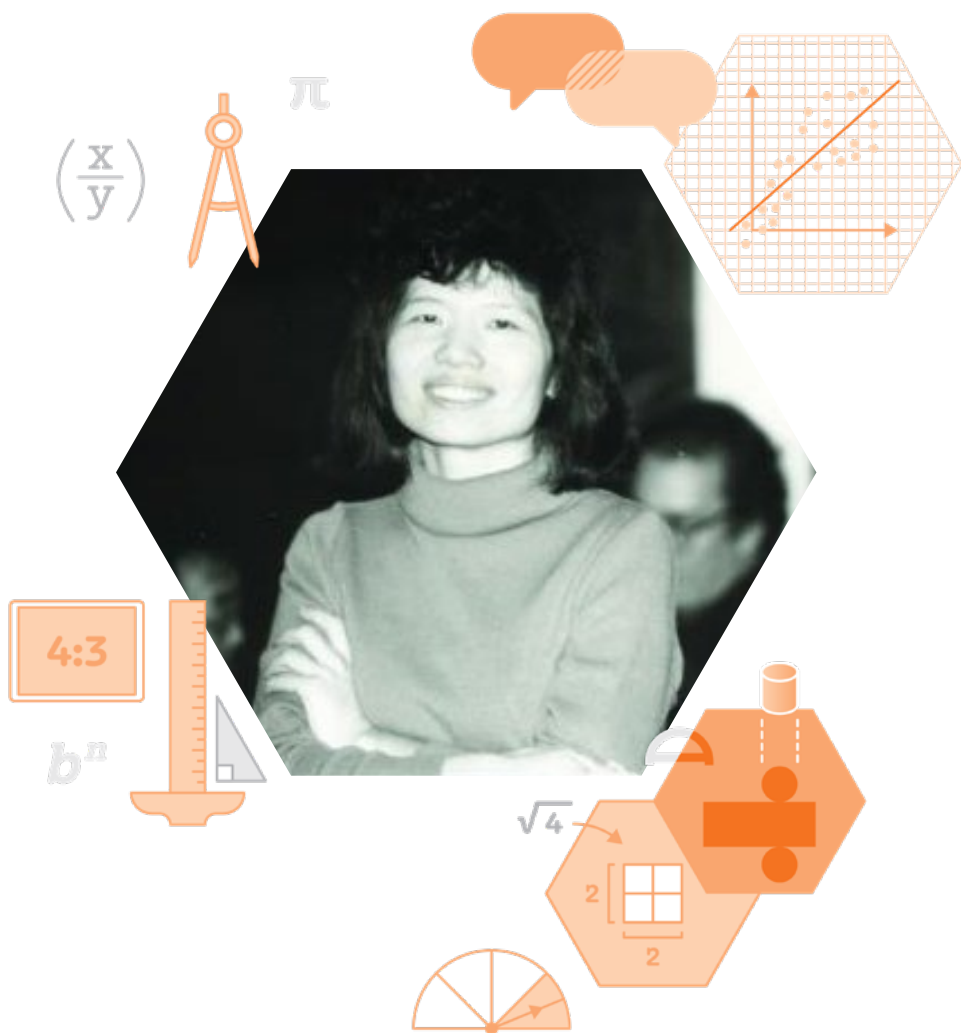


This individual has published more than 200 articles on graphs.

Jama Musse Jama photo by Gerard van de Bruinhorst is licensed under CC BY-SA 4.0.



Fan Chung



Fan Chung

Born October 9, 1949 in Taiwan, Fan Chung expressed interest in mathematics at a young age. Influenced by her father, an engineer, she studied at the National Taiwan University and the University of Pennsylvania, where she scored highest in her class on the graduate qualifying exam.

Chung worked at Bell Laboratories for 20 years before she left to teach mathematics at the University of Pennsylvania. Her contributions to graphic studies include more than 200 papers and three books.

Chung accepted a professorship position at the University of California San Diego in 1995, where she retired in 2016. She continues her work at UC San Diego as a mentor for both young mathematicians and part-time professors.

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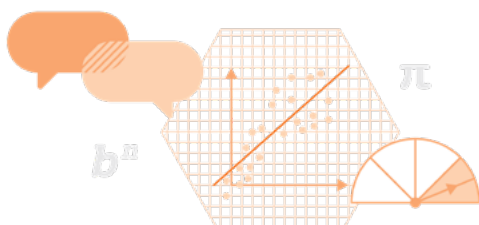


This individual published an open letter to Thomas Jefferson, using Jefferson's own words in the Declaration of Independence to challenge his beliefs on racism and slavery.



This individual ended up taking a position at University of California, Berkeley almost a decade racism kept them from it.

Fan Chung photo by Konrad Jacobs is licensed under CC BY-SA 2.0.



Annie Easley



Annie Easley (1933–2011)

Born in Birmingham, Alabama, Annie Easley faced limited opportunities in both her education and career as a result of segregation. Still, Easley attended Xavier University in New Orleans, earning a degree in pharmacy.

Jim Crow laws such as literacy test and poll tax requirements were intended to prevent African Americans from voting. Easley's degree exempted her from the literacy test, but she was still charged a poll tax. Easley worked to help others pass the literacy test.

In 1964 Easley moved to Cleveland, Ohio, but soon afterwards the program she intended to take was eliminated. This setback led her to work at the NASA Research Center in Cleveland. There she worked for 34 years developing and implementing computer codes. Her work leading the software for the Centaur rocket stage helped lay the foundation for the technology used in space shuttles and military and weather satellites. She was one of the first African Americans to work as a computer scientist at NASA.

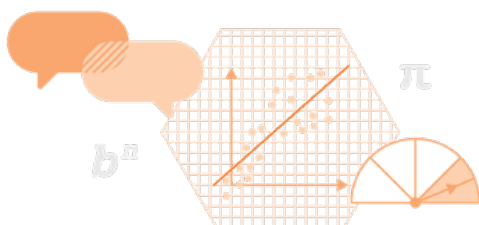
Now that you know more about Annie Easley, find individuals who meet the following descriptions:



This individual, despite holding a Ph.D. in mathematics, faced continued gender discrimination, anti-Semitism, and eventually expulsion from her professorship by the Nazi government.



This individual wrote the first English textbook on the subject of physical geography.



Mary Sommerville



Mary Somerville (1780–1872)

Mary Somerville studied mathematics and astronomy at a time when such things were frowned upon—by her well-connected Scottish family and by 18th-century society in general. She bought books, including Euclid's "Elements," from her brother's tutor, and read them late at night. Somerville married and moved to England with her husband. She was unhappy there as her husband believed that women should not pursue education. After her husband's death she returned to both Scotland and her studies. Her second husband encouraged her pursuits and introduced her to some of the period's great intellectuals.

Somerville's work on the relationship between light and magnetism was published in 1826. In the 6th edition of *Connexion*, she and a group of others discussed a hypothetical planet—a prediction that came true in 1846 with the discovery of Neptune. Additionally, her 1848 book, "Physical Geography," was the first English textbook on the subject. She also was one of the first women to be nominated to the Royal Astronomy Society.

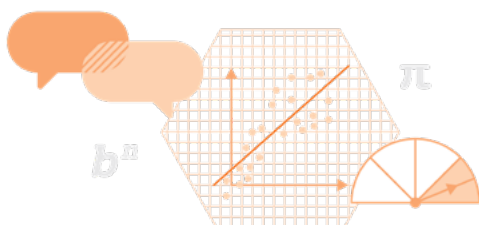
Now that you know more about Mary Somerville, find individuals who meet the following descriptions:



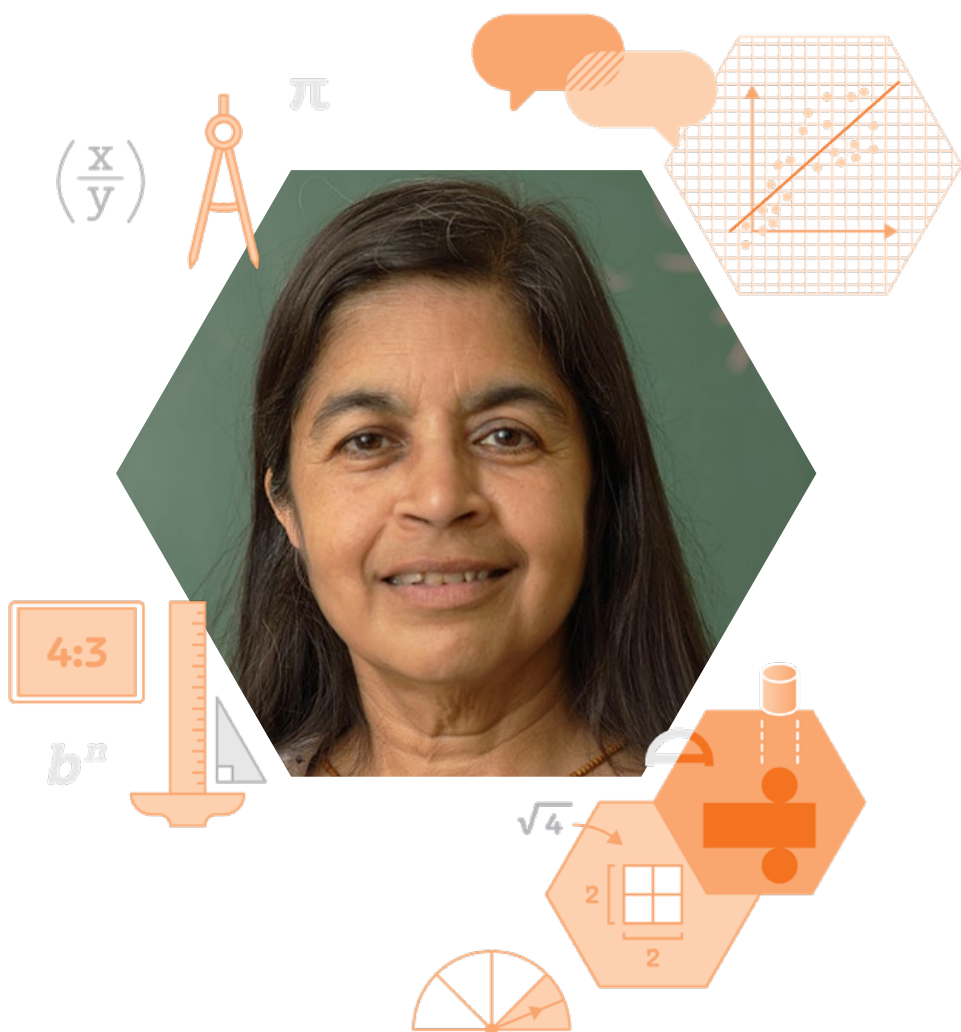
This individual entered University of Pennsylvania graduate programs with the highest qualifying score in mathematics in their class.



This individual is known for their research on traditional Somali board games.



Nalini Joshi



Nalini Joshi

Nalini Joshi is an Australian mathematician. She spent her childhood in Burma (present day Myanmar), where she lived near jungles with wild animals and was given great freedom to explore. As a result, she described seeing everything around her as mathematics.

In 1981 she graduated with a Bachelor of Science from the University of Sydney, followed by a Ph.D. from Princeton University. Joshi became a lecturer in Australia, where she held a number of positions until moving to the University of Sydney. There she became chair of Applied Mathematics. In 2015, Joshi co-founded the Science in Australia Gender Equity program with the goal of increasing the retention of women in STEM careers.

In 2018 she was elected vice president of the International Mathematical Union. Joshi has received countless awards for her lecture work. In 2016, Queen Elizabeth II recognized Joshi for her service to mathematics, education, and diversity by appointing her an Officer of the Order of Australia. The appointment is one of the highest honors the Queen can bestow on an Australian.

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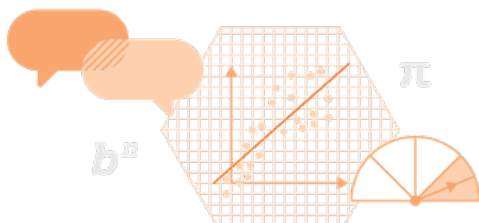


This individual was one of the first women to be nominated for the Royal Astronomical Society.



This individual was the first woman to win the Academy of Sciences Prize.

Nalini Joshi photo by Ted Sealey is licensed under CC-BY-SA-4.0.



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Joan Clarke

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ANSWERS

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Jama Musse Jama
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