Argelia Vélez-Rodríguez (1936 – Present)

Queen Mary University of London

The first black woman to receive a doctorate in Mathematics in Cuba

"There are two major issues facing minorities in their educational development, […] one is the socio-economic factor, and the other is the quality of preparation [they] receive."

Argelia Vélez-Rodríguez is a Cuban mathematician. Argelia was born during a time of education reform. Her interest in Mathematics was noted by her teachers when she won a Mathematics competition at age 9. She proceeded to study Mathematics at the Marianao Institute (1952-1955), having her first son in 1955. After her degree, she joined the University of Havana (1955-1960) to complete her Ph.D. using differential equations to study astronomical orbits. At the time only about 10% of the population in Cuba was black, and she became the first Black woman to receive a doctorate in Mathematics.

In Texas College, she got involved in education of the National Science Foundation, and later became involved in programs for black students and other minorities. She joined the Bishop College in Dallas, Texas and there became an appointed chair of the Department of Mathematical Science (1975-1978). Later, she became a manager of the Minority Institutions Science Program at the US Department of Education in Washington, D.C. A lot of her life's work was focused on teaching mathematics in a manner which would be beneficial to students who were part of a minority.

Discrimination in the United States

Due to several political problems in Cuba, Argelia and her family emigrated to USA (1962), although her husband was only able to leave Cuba 3 years later. She mentions that whilst in Cuba she never felt discriminated for either her ethnicity, or for being woman. Despite encountering a better life in the US, she also encountered discrimination for being both black and a woman.

Argelia Velez-Rodriguez's daughter, Argelia Rodriguez., received her B.S. degree from Stanford University in 1980, and her M.B.A. degree from the Harvard Business School in 1984. She spent almost a quarter-century as the president and CEO of the District of Columbia College Access Program (DC-CAP), a start-up nonprofit which she brought to success by establishing a college-going culture and tripling the number of students who graduate .

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Kathleen Ollerenshaw (1912 – 2014)

Deaf politician and mathematician

Queen Mary University of London

"Mathematics is the one school subject not dependent on hearing."

"That this should have been afforded to someone who had, [..], been out of active mathematics research for over 40 years will, I hope, encourage others. The delight of discovery is not a privilege reserved solely for the young"

Dame Kathleen Ollerenshaw (1912-2014) was an English mathematician and politician. Becoming deaf from the age of 8, she very quickly learned to lip-read, later receiving a hearing aid at age 37. Despite growing up in a society not accessible to hearing impairment, Ollerenshaw did not let this set her back. She was appointed Dame Commander in 1970 for services to education, appointed Lord Mayor of Manchester in 1975, and was the founding president of the Institute of Mathematics in 1978. Ollerenshaw received her doctorate from the University of Oxford for her work on critical lattices, which describe how to most efficiently stack geometric objects. She completed her Ph.D. without submitting a thesis, writing 5 research papers on the subject in two years.

Recreational Mathematics:

Later in her career, she transitioned into amateur astronomy and solved recreational maths puzzles alongside her political work and education. In 1980, Ollerenshaw was the first person to create an algorithm for solving a Rubik's cube, and she also made notable breakthroughs with magic squares and many other puzzles. Throughout her life, she published at least 26 mathematical papers.

'Subliminal Learning' was a technique developed by Ollerenshaw in boarding school, in which she would trace important aspects of a problem, such as shapes or equations, with her finger on her wall before going to sleep. She would wake up with the facts or arguments she needed clearly imprinted in her mind.

Ollerenshaw was truly multi-talented; she even played on a women's ice-hockey team that represented England. She also learnt how to sail, climb, and ski! Moreover, after having received her hearing aids, she began to appreciate music and became involved in the creation of what is now known as the Royal Northern College of Music.

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Emmy Noether (1882 – 1935)

Jewish war-time mathematician

Queen Mary University of London

"Fraulein Noether was the most significant mathematical genius thus far produced since the higher education of women began." - Albert Einstein

In a time when women were often excluded from academic circles, Noether pushed beyond these limitations and made significant contributions to mathematics and theoretical physics. Her most famous achievement, Noether's theorem, established a profound connection between symmetries in nature and the conservation laws of physics. Noether's story is a testament to the power of perseverance and the impact one person can have, regardless of the barriers they face.

'**Noether's Theorem**' - Every continuous symmetry in a physical system corresponds to a conserved quantity. For example, time symmetry leads to energy conservation, and spatial symmetry leads to momentum conservation. This theorem links the concepts of symmetry and conservation laws, making it fundamental in physics.

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1882 - Born in Erlangen, Germany.
1907 - Earned her doctorate in mathematics from the University of Erlangen.
1915 - Invited to the University of Göttingen by David Hilbert and Felix Klein.
1918 - Formulated Noether's theorem, linking symmetries to conservation laws.
1919 - Officially joined the faculty at the University of Göttingen.
1921-1928 - Made major contributions to abstract algebra, especially ring and ideal theory.
1932 - Received the Ackermann–Teubner Memorial Prize for her mathematical work.
1933 - Fled Nazi Germany and began teaching at Bryn Mawr College in the U.S.
1935 - Passed away on April 14, leaving a lasting impact on mathematics and physics.

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Universities often did not allow women to hold official positions or receive salaries, regardless of their qualifications. Despite her groundbreaking contributions, Noether worked without pay for several years at the University of Göttingen, where she lectured under a male colleague's name until she was granted a formal position. She was dismissed by the Nazis in 1933 due to her Jewish heritage.

Nalini Joshi (1958 - Present)

A Burmese-Australian mathematician

Queen Mary University of London

"I struggle with maths everyday - the difference is that I enjoy the struggle. It's a myth that to be good at something, it must come easy."

Nalini Joshi is a prominent Australian mathematician known for her work in nonlinear differential and difference equations, particularly in the field of integrable systems. Born in Burma (now Myanmar) and raised in Australia, Joshi became the first woman in Australia to be appointed as a Professor of Mathematics at the University of Sydney. She has held several leadership positions, including being the president of the Australian Mathematical Society and serving on various advisory panels for scientific organizations. Joshi is also an advocate for gender equity in science and mathematics, working to support and inspire women in STEM fields.

Achievements:

2006: Fellow of the Australian Academy of Science - for contributions to mathematics and her leadership in the field.

2010: Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE) - outstanding contributions to science and engineering.

2017: Mathematical Association of New South Wales (MANSW) Distinguished Service Award - Recognized for her service and contributions to the mathematical community.

2020: Order of Australia (AM) - Appointed a Member of the Order of Australia for significant service to mathematics education, research, and gender equity in STEM fields.

Joshi studied at the University of Sydney, where she earned a Bachelor of Science with Honours in Mathematics. Her exceptional performance and enthusiasm for the subject led her to continue her studies, where she completed a PhD in Mathematics. Her research focused on integrable systems and nonlinear differential equations, areas that captivated her due to their complexity and elegant solutions.

Nalini Joshi has been a dedicated advocate, promoting diversity in STEM, focusing on supporting women and under-represented groups in science and mathematics. As President of the Australian Mathematical Society, she led initiatives to enhance inclusivity and representation. Joshi has actively mentored young researchers, including guiding women through academic challenges and promoting their advancement in the field. Her involvement in programs like the Australian Mathematics Trust and the STEM Women organization highlights her commitment to inspiring and engaging students from diverse backgrounds. Through these efforts, Joshi has played a crucial role in fostering a more inclusive and supportive scientific community.

Scan for additional information!

Sofia Kovalevskaya (1850 - 1891)

Queen Mary University of London

First female mathematics professor making large contributions to mechanics

"It is impossible to be a mathematician without being a poet in soul."

Kovalevskaya was the first female mathematics professor in the world, teaching in Stockholm. Her paper entitled, *'The Theory of Partial Differential Equations'* was published in Crelle's journal whilst she was still an unknown researcher. She demonstrated a high aptitude for mathematical excellence from a young age, teaching herself trigonometry to work her way through a physic textbook. This was noticed by the author, who was her sole supporter in ensuring she pursued an education in St. Petersburg.

At the time, the closest university allowing women was in Switzerland and women were unable to travel without a male escort. This pushed Sofia into her 'marriage of convenience' with her husband, Vladimir Kovalevsky, who was a Russian nihilist supporting the emancipation of women. This meant Kovalevskaya could now travel freely to pursue an education. However, her fight to learn more did not end here as many of the best institutions (the ones Kovalevskaya aimed to learn at) still did not allow female students. Her intelligence and drive caught the attention of Karl Weierstrass, one of the most renowned German mathematicians in 1869 who agreed to privately tutor her upon her acceptance as the first female student at Heidelberg University.

"Many who have had an opportunity of knowing any more about mathematics […] consider it an arid science. In reality, however, it is a science which requires a great amount of imagination."

In 1883, Kovalevskaya's husband, after having separated with his wife, committed suicide after a stream of financial difficulty. This left Sofia with a young child and in a state of grief. This only pushed her further into her work, and she was given the position as Privat docent. However, to prove her competency as a female mathematician, she had to work for a year as an unpaid lecturer providing lessons in partial differential equations. In 1884, she was then awarded the official position of Professor. This did not go unnoticed, with a well-known mathematician stating in the local papers that, '*a female professor is a pernicious and unpleasant phenomenon - even, one might say, a monstrosity.*' This blatant criticism of her skill did not stop her from pursuing her career further.

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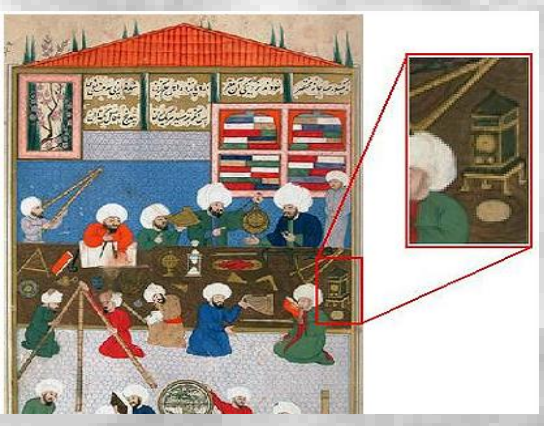
At the height of her career in 1891, Sofia was diagnosed with Pneumonia and she died soon after. Her tutor described Kovalevskaya as showing *'how through deeds that women have been alienated from the highest strivings of mankind because of prejudice.'*

Taqi ad-Din Muhammad Ibn Ma'ruf Ash-Shami Al-Asadi (1526 – 1585)

Arab Muslim polymath

"The most important astronomer of Ottoman Turkey."
– Encyclopaedia of Islam

"One of the greatest scientists of all time"
– Donald Routledge Hill



Taqi ad-Din was a versatile scholar in the Ottoman Empire, writing over 90 books on various subjects such as astronomy, clocks, engineering, mathematics, mechanics, optics, and natural philosophy. In 1574, the Ottoman Sultan Murad III invited him to establish an observatory in Istanbul, where he used instruments like an armillary sphere and mechanical clocks to observe the Great Comet of 1577. He also used European celestial and terrestrial globes received through gift exchanges. One of his major achievements from the observatory was a work titled *"The tree of ultimate knowledge in the Kingdom of the Revolving Spheres: The astronomical tables of the King of Kings (Murad III)"*. This book, based on observations in Egypt and Istanbul, built upon Ulugh Beg's 15th-century work, the Zij-i Sultani. It contains calculations, discussions on astronomical clocks, celestial circles, and details about three eclipses observed in Cairo and Istanbul.

Keeping the time

Taqi al-Din was tasked with creating a clock for accurate call to prayer timing, leading to his first book on building mechanical clocks in 1563, titled *"al-Kawakib al-Durriya fi Bengamat al-Dawriyya"*. He believed this would offer a precise understanding of celestial motions. He learned from European clockmakers and studied clocks in Semiz Ali Pasha's treasury, where he examined three types of clocks: those powered by weights, springs, and lever escapements. As Chief Astronomer, he designed a mechanical astronomical clock with three dials, enhancing observations at the Constantinople observatory.

Polymath - an individual whose knowledge spans many different subjects, used to describe the great thinkers of ancient times.

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In 1551, Taqi al-Din created an early version of the steam turbine: a self-rotating spit. He also described four water-raising devices, including animal-powered pumps and paddle wheel-driven pumps. His innovative concepts predated many modern engines and laid the groundwork for steam engine development.