Mathematicians A–Z Cartwright Devi Easley Fawcett



Mathematical Institute



Mary Cartwright (England, 1900–1998)

Born in Northamptonshire, Mary Cartwright completed her undergraduate and DPhil studies at Oxford. After completing her thesis on "The Zeros of Integral Functions of Special Types", she moved to Cambridge, staying there for the remainder of her career. During World War II, she became one of the early pioneers of chaos theory through a collaboration with J.E. Littlewood (English mathematician, 1885–1977) in which they developed a thorough analysis of a dynamical system for radio waves and radar. Their work described a phenomenon that is now recognised as the butterfly effect (see below) – an extreme sensitivity of system behaviour to initial conditions – although the significance of this work was not generally understood for another 20 years. A highly distinguished pure and applied mathematician, she was the first female mathematician elected Fellow of the Royal Society (in 1947) and also the first woman to serve on its council. In 1969 she became Dame Mary Cartwright, Dame Commander of the British Empire, after being honoured by Queen Elizabeth II.

Shakuntala Devi (India, 1929–2013)

Shakuntala Devi was born in India to a family of circus performers. Although she did not have a formal education, she displayed a remarkable skill for mental arithmetic at the age of 3 and soon began performing at public road shows. Thanks to her talents, she became known as the "human computer". Two of her most famous exploits include finding the 23rd root of a 201-digit number within 50 seconds – outperforming contemporary computers by twelve seconds – and determining the product of two randomly selected 13-digit numbers within 28 seconds: 7,686,369,774,870 × 2,465,099,745,779. Devi was later inducted into the 1982 Guinness Book of *World Records* for this feat and her remarkable abilities. In 1977, she published one of the first academic studies of homosexuality within India in which she advocated for its decriminalisation and for acceptance of the community. She also achieved success as an astrologer, and was a prolific writer, publishing several collections of short stories, novels, cookbooks, and books on her mental calculation methods.

Annie Easley (USA, 1933–2011)

Annie Easley was a computer scientist, mathematician, rocket scientist, and one of the first African-American employees of NASA. Originally trained in pharmacy, she joined NACA (the predecessor of NASA) in 1955 as a "computer", performing long calculations by hand for researchers. With the subsequent introduction of electronic computers, Easley retrained as a mathematician and computer technician, becoming proficient in *Fortran* and contributing to the development of software for shuttle & satellite launches (such as for the *Centaur* high-energy upper rocket stage). She also continued her education while working full-time at NASA, completing a mathematics BSc. at Cleveland State University in 1977. Easley was known to be highly dedicated to outreach; she participated in school tutoring programmes and the Speaker's Bureau, educating about NASA's mission and inspiring female and minority students to consider STEM careers. In 2021, the International Astronomical Union named a crater on the Moon in her honour (*Easley*: 23.69°S, 87.97°E).



Born in Cambridge, Philippa Fawcett achieved worldwide fame in 1890 when she became the first woman to obtain the top score in the University of Cambridge Mathematical Tripos Examinations (scoring 13% higher than the next best student). However, since men and women were not ranked together, she was denied the title of "Senior Wrangler" and was instead placed "above the Senior Wrangler". Her achievement spurred discussion about women's abilities and rights, and particularly influenced the contemporary women's suffrage movement in the UK. In 1902, Fawcett applied to the Transvaal Republic (now a South African state) for permission to set up an education system following the Second Boer War; once permission was granted, she was appointed lecturer in mathematics at the Normal School (a teacher training college) in Johannesburg. She remained there, setting up schools throughout the country, until 1905. Although she was denied her Cambridge degree because of her gender, Fawcett was one of the "steamboat ladies" who travelled to Ireland between 1904 & 1907 to receive an *ad eundem* degree from the





Long exposure photograph of a light source fixed to the end of a double pendulum. This system is chaotic and exhibits the *butterfly effect*.

Oxford Mathematics



Shakuntala Devi performing calculations during a demonstration in New York in 1976.



Easley at the NASA Lewis Research Center; cover of the *Science and Engineering Newsletter*, Vol. 5 No. 1, Spring 1982.



University of Dublin.

The 1891 Newnham College Women's hockey team. Fawcett is seated front right in the photograph.

Poster sources Cartwright: *Mary Cartwright*; Physics Today (2015) DOI:10.1063/PT.5.031114, BBC, mathshistory.st-andrews. ac.uk, Wikipedia. Devi: Wikipedia, the New York Times, *Shakuntala Devi*; Hinduism Today (2000), *Genius Shakuntala Devi mourned*; Eastern Eye London (2013). Easley: Wikipedia, NASA. Fawcett: Wikipedia, mathshistory.st-andrews.ac.uk.

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