Wang
Hoàng Xuân
Yanovskaya
Zames
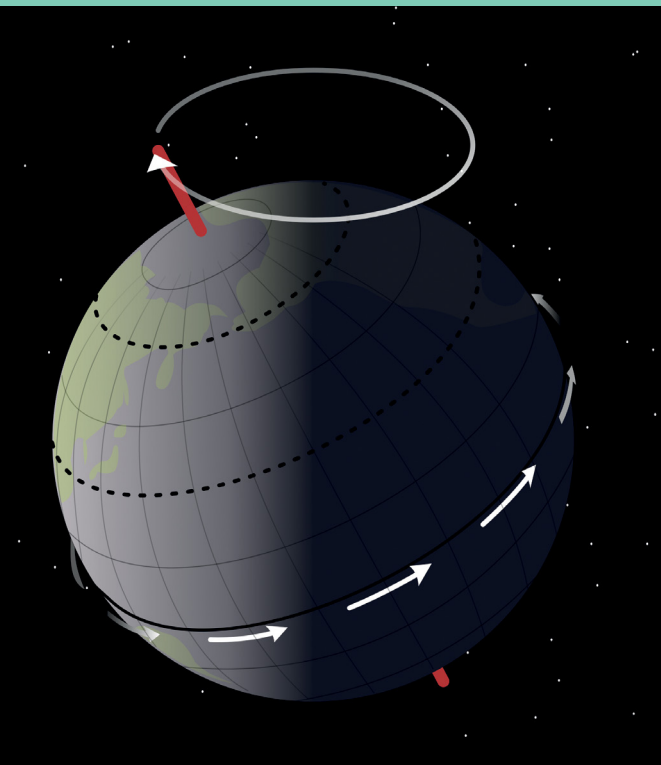
Wang Zhenyi
(China, 1768–97)

Wang Zhenyi was a Chinese scientist and mathematician during the Qing dynasty. Despite societal customs preventing women from receiving education, she studied a vast array of subjects such as astronomy, mathematics, history, geography, medicine, and literature, and was almost entirely self-taught in the first two. She produced at least six books on astronomy and mathematics, and rewrote (and simplified) other mathematical works such as *Principles of Calculation* by Mei Wending (Chinese Mathematician, 1633–1721). Wang also authored several articles, often independently rediscovering explanations for astronomical phenomena such as lunar and solar eclipses and the precession of the equinoxes (see inset). In her short life she also became an accomplished poet, writing about corruption and the discrepancy between the lives of the rich and poor.

Hoàng Xuân Sính
(Vietnam, b. 1933)

Hoàng Xuân Sính was born in Hanoi, Vietnam in 1933. In 1951, after obtaining a bachelor's degree in English and French in Hanoi, she travelled to France to obtain a baccalaureate in mathematics. She began teaching mathematics at the Hanoi National University of Education in 1959. Hoàng Xuân first met Alexander Grothendieck (French mathematician, 1928–2014) in late 1967, when he was visiting Vietnam to protest the Vietnam War by holding lectures on *category theory* (see inset) in the countryside surrounding Hanoi, as it was being bombed. Hoàng Xuân attended and took notes for these lectures; later, when Grothendieck returned to work in France, he supervised Hoàng Xuân's doctoral thesis by correspondence. When she was later promoted to professor, Hoàng Xuân became the first female full professor in Vietnam in any scientific or technical field. Over the last several decades she has played a leading role in developing mathematics in Vietnam, through her own teaching and her founding of Thang Long University in 1988.

Sofya Yanovskaya
(Belarus, 1896–1966)

Sofya Alexandrovna Yanovskaya was born in Pruzhany – at the time, part of the Russian Empire; now part of Belarus – in 1896. As a mathematics student at Novorossiisk University of Odessa, she became politically active in the Russian Revolution, joining the Bolshevik wing of the Russian Communist Party in 1918. After a hiatus in her studies to focus on politics, Yanovskaya began attending mathematics seminars at Moscow State University in 1923. The following year she entered the Institute of Red Professors (a Marxist institute of graduate-level education) and in 1931 became a full professor at Moscow State University. Yanovskaya has been credited as a founder of modern logic research and education in Russia through her translation, interpretation, and dissemination of works of Western colleagues, without which young researchers would have been at a disadvantage, due to the Iron Curtain. Yanovskaya was also instrumental in reinforcing the separation of mathematical philosophy and mathematical logic as disciplines of study. From 1959 to her death in 1966, she held the Chair of Mathematical Logic at Moscow State University.
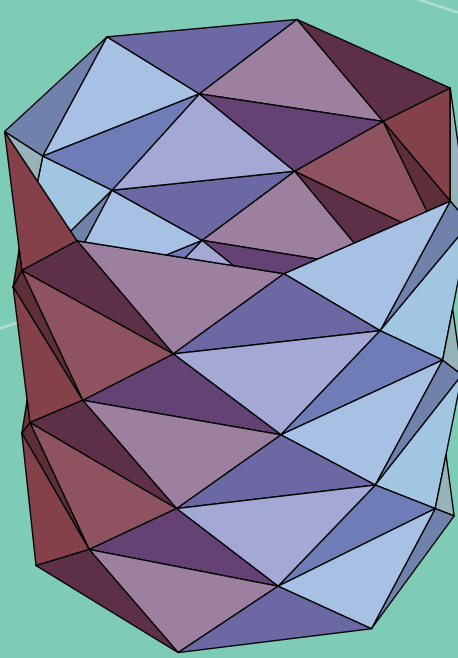
Frieda Zames
(USA, 1932–2005)

Frieda Zames was born in New York in 1932. Following polio as a child, she would go on to earn a PhD in mathematics education from New York University in 1972 despite facing discrimination because of her crutch and brace use. Her career in activism began in the 1970s after she joined Disabled In Action, a disability rights advocacy group. One successful campaign of Zames and others resulted in New York City buses becoming wheelchair accessible, after years of protest, civil disobedience, and litigation. Zames was awarded the George Pólya Prize from the Mathematical Association of America in 1978, for her expository article on the *Cylinder Area Paradox* (see inset). Later, in 2001, Zames and her sister (Doris Zames Fleisher, humanities academic at the New Jersey Institute of Technology) published *The Disability Rights Movement: From Charity to Confrontation*, a historical survey of the disability rights movement in the United States. Zames retired in 2000 from the New Jersey Institute of Technology as Associate Professor of Mathematics Emeritus, and was vice president of Disabled in Action at the time of her death, after holding the presidency several times.

The *axial precession* of an astronomical body (historically known as the *precession of the equinoxes* in the case of Earth) is the gradual change in the orientation of the body's rotational axis, due to gravity. In her article *Dispute of the Procession of the Equinoxes,* Wang gave an independent account of how the equinoxes move and how to calculate their movement precisely. The white circle in the above image indicates the precession of the Earth's rotational axis.

Category theory is a field of pure mathematics that studies abstract mathematical structures and the relations between them. In the mid 20th century, Grothendieck revolutionarily recast algebraic geometry in this framework. (Above: Grothendieck, centre; Hoàng Xuân far left.)

The main building of the Moscow State University, constructed between 1947–53.

The *Cylinder Area Paradox* is the name given to the insight that the area of a smooth surface *S* cannot always be accurately approximated by polygons (such as triangles) on *S*. A counterexample is the *Schwarz lantern*, left.

Oxford
Mathematics