SOFIA KORIN-KUROVSKAYA KOVALEVSKY

Some students complain about how difficult it is to learn calculus, but **Sofia (Sonya or Sophie) Korin-Kurovskaya Kovalevsky** (January 15, 1850 – February 10, 1891) first studied the subject at age 11 under most trying conditions. Upon moving to Palibino from Moscow, where she was born, her family redecorated their new home. There was enough wallpaper for all but one of the many rooms in the massive house, her bedroom. Believing it to be too much trouble to send all the way to St. Petersburg for more wallpaper, her father Vasily papered the walls of her bedroom with sheets of lithographed lectures of Mikhail Ostrogradski that he had used in his youth. The lectures were on differential and integral calculus, but were not arranged in proper sequence on the walls, making them difficult to follow. Still the curious formulas sparked the bright youngster's interest in mathematics. In her autobiography, *A Russian Childhood*, Kovalevsky wrote:

> "The meaning of these concepts I naturally could not yet grasp, but they acted on my imagination, instilling in me a reverence for mathematics as an exalted and mysterious science which opens up to a new world of wonders, inaccessible to ordinary mortals."

Her uncle Pyotr, who greatly respected mathematics, further stirred her curiosity and the two had many discussions about mathematical ideas. Kovalevskaya had an unusual ability to learn algebra and geometry, but her father did not feel mathematics was a fit subject for girls and ended her formal mathematical instruction. She borrowed an algebra book and continued to study it at night "under the covers." Then a neighbor, Professor Tyrtov, gave her a copy of a physics book he had written. When she came to the topic of optics she encountered trigonometry, a branch of mathematics that she had

never heard of before. To understand the material, she reinvented the concept of the sine using the method by which it had been historically developed. Tyrtov was so astonished, going so far as to compare her to Blaise Pascal, he convinced Kovalevsky's father to allow her to resume her mathematical instruction. Thus Vasily hired Alexander N. Strannoliubsky, who would come to be considered the foremost Russian teacher of mathematics, to tutor his daughter in the subject.

After completing her secondary schooling, Kovalevsky was determined to continue her education, but Russian universities were closed to women at the time and the nearest universities that accepted them were in Switzerland. As young, unmarried women were not permitted to travel alone, the eighteen-year-old made a marriage of convenience with Vladimir Kovalevsky, a young paleontologist, who had originally been considered a match for her older sister. The sometimes-turbulent marriage lasted fifteen years, producing a daughter. Kovalevsky moved to Heidelberg to study science and mathematics, only to discover that the university did not allow women to matriculate. She persisted and was finally allowed to attend lectures unofficially. She spent the next two years learning from some of the foremost scientists in Europe. Although she could not earn a degree, her Heidelberg professors were so impressed with her ability that, in 1870, they sent her, armed with their recommendations, to Berlin and Karl Weierstrass, the most renowned German mathematician of the period. She convinced Weierstrass to take her as a student after he made an evaluation of her mathematical understanding and was convinced that she was mathematically brilliant. Since the university did not accept women students, he could only give her private lessons. Despite numerous obstacles put in her path, Kovalevsky obtained a Ph.D. from the University of Göttingen in 1874. However, her degree, her talent, and the prestige of her teacher Weierstrass, were not enough for a woman to obtain employment as a mathematician. Disappointed, the brilliant young woman turned her attention to literary pursuits.

After her husband, from whom she had been separated for two years, committed suicide, Kovalevsky,

who blamed herself for the tragedy, locked herself in her home for days in an attempt to starve herself to death. Fortunately she was unsuccessful and upon recovering returned to mathematics in 1880. She was contacted by Gösta Mittag-Leffler, a former student of Weierstrass and at the time the rector of Stockholm University. She was invited to come and teach at Stockholm, with the catch that she would not be allowed to become a member of the faculty. She would be allowed to lecture as *privatdozent* at the University. She began her duties in 1883 and her lectures proved a huge success. By the end of the first year she gained a tenured position at the university, was appointed an editor for a mathematics journal, and published her first paper on crystals. In 1885 she was appointed as a full professor, becoming the first woman since the physicist Laura Bassi and the mathematician Maria Gaetana Agnesi to hold a chair at a European university.

The high point of Kovalevsky's career was in 1888, when she won the Prix Bordin, a prestigious prize given by the French Academy of Sciences. The recognition was for her memoir, *On the Problem of the Rotation of a Solid Body about a Fixed Point*, in which she fully resolved a long standing mathematical question. In 1889, she became the first woman to be elected to the Russian Academy of Sciences, but she was not allowed to attend the Academy's meetings. This dubious honor did not earn her offers to teach in Russian universities. Kovalevsky wished to return to Russia because she had left her daughter behind in Moscow and her sister was dying, but all her efforts were turned aside by the tsarist government.

In Sweden Kovalevsky was a celebrity, who corresponded with people from all over the world who wrote her for advice on their mathematical work. In addition to her mathematical projects, between 1881 and her unexpected death of pneumonia at the age of forty-one, Kovalevsky completed two novels, collaborated on two plays, and wrote numerous newspaper articles. Her ten published papers on differential equations and applied mechanics provided the groundwork for additional discoveries by

other mathematicians.

Quotation of the Day: “Say what you know, do what you must, come what may.” – Sofia Kovalevsky’s motto.