

Impact Statement

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Digital Art

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Unsung Hero: Dr. Sofya Kovalevskaya

Faded old pages with intimidating scribbles of math expressions covered the nursery walls. Little did the family know, this was to foreshadow the math pioneer their daughter would later become. Born in 1850 in Moscow, Sofia Kovalevskaya found her passion early studying her father's college calculus notes which were pasted on the walls of their new estate house for want of better wallpaper. At the age of fourteen, Kovalevskaya taught herself trigonometry to better understand the physics book her neighbor Professor Tyrtoff authored. These early excursions into mathematics foretold of a young woman who would grow up to be one of the most influential mathematicians of the nineteenth century, making breakthroughs not only in differential equations, but also in gender equity.

Kovalevskaya stands out to me because she was a woman deeply passionate about mathematics, a passion I also share. What makes her even more impressive, however, is that she distinguished herself in an era in which her gender made it near impossible to pursue a career in academia. In comparison, I live in a time when women have a lot more opportunities, and researching Kovalevskaya's life has strengthened my appreciation of these opportunities. Kovalevskaya was undoubtedly a trailblazer – she was the first woman in Europe to earn a doctorate in mathematics; the first woman to be an editor of *Acta Mathematica*, a prestigious mathematics journal; and formulated groundbreaking theories still relevant today. Her paper on the Kovalevskaya top, which elegantly predicts the motion of an asymmetric rigid object around a fixed point, became so highly regarded that it won the prestigious Prix Bordin award. But looking more deeply, I find that Kovalevskaya's achievements are not what impresses me the most – it is how she chose to follow her passion instead of obsequiously surrendering to the dictates of 19th century patriarchy. Despite having a doctorate and having been tutored by Karl Weierstrass, one of the most famous mathematicians at the time, Kovalevskaya had great difficulty finding work due to her gender. For a while, she was an assistant in her husband's construction business and helped neighbors electrify streetlights. To deal with her husband's death in 1883, Kovalevskaya embraced mathematics not only as a passion but also a coping strategy. She even chose to continue pursuing mathematics instead of accepting a proposal of marriage from Maxim Kovalevsky, a man whom she would later come to love. As a result of her personal hardships, Kovalevskaya sank into depression many times throughout her life but persevered through it all by focusing on her passions.

It is strange that despite all of Kovalevskaya's success, achievement, and talent, pundits like Felix Klein, a German mathematician and historian, still had the audacity to claim that "her works are done in the style of Weierstrass and so one doesn't know how much of her own ideas are in them" (Rappaport 27). Despite the criticism, Kovalevskaya demonstrated extraordinary tenacity in accomplishing her goals. She often faced hardships, like the death of family members, her struggle to find a stable job, and condemnation of her having been appointed lecturer at the University of Stockholm. A local newspaper even wrote that "A female professor is a pernicious and unpleasant phenomenon – even, one might say, a monstrosity" (Rappaport 30). Despite this, her lectures consistently garnered positive reception, and she continued to publish groundbreaking, award-winning papers until her death at 41 from pneumonia. Another thing that interests me is that Kovalevskaya was also an avid writer and advocate for women's rights. She wrote literature to cope with her emotions, express creativity, and explore feminist ideas.

Her novel *Nihilist Girl* and memoir *A Russian Childhood* advocates for women's independence, education, and social reform. These qualities are a testament to the fact that Kovalevskaya was more than simply a mathematician, she was in fact a multi-dimensional scholar and a pioneering protofeminist.

My artwork portrays Kovalevskaya's early passion and her notable achievements. I included details of her wallpaper made partly of calculus notes, and how she self-studied trigonometry in her room. The formulas and diagrams for the Cauchy-Kovalevskaya theorem and the Kovalevskaya top are illuminated beside her to showcase the breakthroughs she made in mathematics and physics. Saturn in the background is a nod to her paper on Saturn's rings, which is a component of her doctoral dissertation. The overall setting of the portrait evokes the triumphs of a visionary who did not let societal limits stop her from pursuing her passions. Kovalevskaya herself holds a pen and a book to emphasize her dedication to research and scholarship.

Kovalevskaya's story is one of indomitable diligence that stirs my soul, pushing me to make better use of the resources and time I have. The fact that Sofia Kovalevskaya accomplished so much during a time when opportunities for women were very limited only serves to make her even more impressive. Her choice to strive for success instead of capitulating to the oppressive dictates of the patriarchy makes me reflect on my current situation too: am I really following my passions, or am I simply constrained by the path society has set me on? I greatly admire Kovalevskaya's independence and will carry her spirit with me as I continue my academic journey. To that end, I will share this piece with my school's Women In STEM Club to help edify them during Women's History Month in March.

References:

<https://mathwomen.agnesscott.org/women/kova.htm>

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