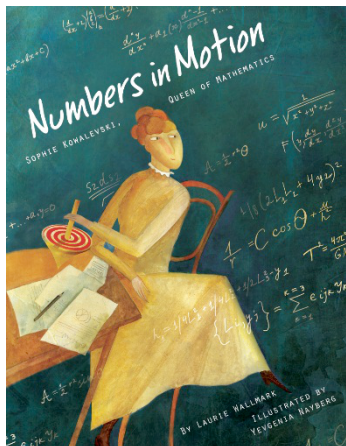


Numbers in Motion: Sophie Kowalevski, Queen of Mathematics

Curriculum Guide



Numbers in Motion:
Sophie Kowalevski, Queen of Mathematics
By Laurie Wallmark, illustrated by Yevgenia Nayberg

ISBN: 9781939547637

Format: Hardcover

Pages: 32pp, color

Category: Non-fiction, picture book biography

Age Range: 6 and up

Background Information:

Sophie's many "firsts" made her a role model for women in math and science. She was the first woman to receive a doctorate in mathematics that required original research, the first to hold a university chair in mathematics, the first to be elected to the Russian Imperial Academy of Sciences, and the first to be the editor of a major scientific journal.

But Sophie was more than a brilliant mathematician. She was also a talented writer. Through the years, the little girl who wrote poetry behind her nanny's back never forgot her love of writing. While teaching and doing mathematical research, Sophie still found the time to write a memoir, novel, short stories, newspaper articles, two plays, and hundreds of poems.

Sophie was the first woman to be a professional mathematician since Hypatia in fifth century Egypt. Her fellow mathematicians didn't care that she was a woman. They knew Sophie's work was equal to that of any mathematician of her time. Sophie published ten papers in mathematics and mechanics, the branch of physics having to do with the study of motion. The methods she discovered have increasing application to mathematical physics today. Sophie's exceptional talent for creative thinking was the fuel that powered her notable accomplishments in both writing and mathematics. Understanding the similarity between the two fields, she said, "The poet must see more deeply than other people, and the mathematician must do the same."

Guided Reading Level V; Grade Level Equivalent 5; Interest Level by Grade 4-8;

CSS-ELA Literacy Strands: L.5.3, 4, 4a, 5, 5a, 5b, 6; RF.5.3, 3, 4, 4, 4c; RI.5.1, 2, 3, 4, 5, 6, 8,9, 10; SL.5.1, 1c, 1d, 2, 3, 4, 5, 6; W.5.2, 3, 4, 7, 8, 9, 9b, 10; **NGSS:** PS2A, PS2B, ETS1A, ETS1B, ETS1C

Educational Description:

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STEM content-History: Women's Rights, Math, Physics, Technology and Science. Solving real world problems. Literary elements: setting, plot and character development, conflict, illustrations enhance meaning and tone, new scientific and mathematical vocabulary. Back matter: Author's Note, Explanation of Sophie's math contributions to society, Roman alphabet vs Cyrillic. Comprehension strategies: make text to world connections, identify cause and effect relationships, main idea and details, sequence of events, author's purpose, compare and contrast then and now.

Themes:

- STEM
- Growth Mind Set: showing determination and perseverance.
- Women Heroes: powerful women in history.
- Critical Thinking Skills: problem solving.

Objectives:

- Connect with literature.
- Teaching children about women's contribution to the field of mathematics.
- Perseverance: Help students understand what it means to set goals and work toward those goals.
- Education: Introduce students to the concept that education is not freely available to all people.
- Problem Solving: Learning ways in which we can approach problems in a variety of ways.

Discussion Questions:

- What things can you notice that involve movement. Can math describe the orbit of a planet? The fall of an object? The way a plane flies?
- Another theme in Sophie's story is determination. What obstacles did she face? How did she achieve her goals despite them? What is something you've achieved by being determined to do it?
- How is women's history shown in the book? Through the text? Through the illustrations? Discuss why girls and women were considered not worth educating. What was the role girls and women were supposed to have in the 19th century? What role did Sophie want? What roles are girls and women supposed to have today? What roles are boys and men supposed to have? How do they differ (if they do)?
- Discuss prejudice and different ways it can block people from following their dreams. Do girls and women still face negative stereotypes about their math abilities? Do other groups of people deal with negative stereotypes about their math abilities?
- Sophie gets married because she needs a man's permission, either her father's or her husband's, to travel to Berlin to study. Do you think her solution makes

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sense? What would you suggest she do? Are there places in the world where women still need a man's permission to travel?

- Sophie wrote books and poems as well as working on complicated math problems. What do the two fields have in common? How do they differ? Why do you think Sophie did both well? What skills are useful in both kinds of work? Are there two things that you enjoy that people think are very different, like math and sports?

Activities:

- **Do your own experiments spinning different kinds of tops** (wooden, glass, clay) and note how their movements differ. Is one kind of top more stable? Is one kind more likely to wobble? Can you draw spirals to show how the tops move?
- **One of the things mathematicians do to solve problems is look for patterns.** How can you do your own experiments recognizing patterns? For example, you could flip coins and note when heads comes up and when tails does. Is there a pattern or are the results random? Look at the spiral on a pinecone and count the spirals in one direction, then in the other. Do you notice a pattern in the numbers? An Italian mathematician called **Fibonacci** found a numeral pattern in natural objects, like sea shell, sunflower seeds, and pine cones. Can you figure it out?
- **Make a list of ways you use math to figure out things.** For example, if you want to divide a pie fairly, so each person gets the same size slice, how do you do it? If you want to save up X amount of money and already have Y amount, how do you figure out how much more money you need?
- **Research two mathematicians/scientists.** Compare the two historical figures. How were their lives different? The same? What contributions did they make?
- **Play 101 and Out Math Game:** This paper and pencil game works well in second to fifth grade classrooms and can be played by teams or in pairs. To play students will need a sheet of paper, a pencil, and one dice. The object of the game is to score as close to 101 without going over or "out." Students take turns rolling the dice. As they roll, they can either take the number as a one or a ten. For example, if a student rolls a 5, they could take it as a 5 or a 50. Students keep a running record of their total as they play.
- **Problem Solving Activity:** Organize the students into teams or pairs. Give the students a real life scenario to problem solve. Some examples might be: How

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can someone with crutches or a wheelchair carry what they need?, How can we reduce waste at our school?, Climate change is real; studies have shown that planting trees can help decrease CO2 levels. How can you encourage people to plant more trees? Give the students time to brain storm and then present their ideas. Discuss how the different groups came up with different approaches and answers to the same problem.

Resources:

- **Math is Fun:** Explore the Fibonacci Sequence
(<https://www.mathsisfun.com/numbers/fibonacci-sequence.html>)
- **PBS:** Historical research checklist
(<https://www.pbs.org/opb/historydetectives/technique/historical-research-checklist/>)
- **Association for Middle Level Education:** Perspective-writing activities bring "a bunch of dead guys" to life.
(<https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/569/Transporting-Historical-Figures-from-Past-to-Present.aspx>)
- **Teaching Made Practical:** Compare and Contrast Activities
(<https://teachingmadepractical.com/compare-contrast-activities/>)

About **Laurie Wallmark:**

Laurie Wallmark has an MFA in Writing for Children and Young Adults from Vermont College of Fine Arts as well as degrees in biochemistry and information systems. When not writing, she teaches computer science at Raritan Valley Community College. She also teach courses on writing for children.

Other books from Laurie Wallmark: *Ada Byron Lovelace and the Thinking Machine*, *Grace Hopper: Queen of Computer Code*, and *Hedy Lamarr's Double Life*.

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About Yevgenia Nayberg

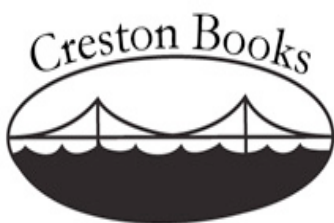
Yevgenia Nayberg is an illustrator, painter, and set and costume designer. Her illustrations have appeared in magazines and picture books, and on theatre posters, music albums, and book covers; her paintings, drawings, and illustrations are held in private collections worldwide. In 2018 she received a Sydney Taylor Silver Medal for her illustrations for *Drop by Drop* by Jaqueline Jules.

About Creston Books:

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