Highlighting Women in Mathematics

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Throughout recorded history, women were largely kept from working in mathematics. Even when their genius, creativity, and work ethic were recognized by some of their male counterparts, they were rarely able to obtain degrees (Sofya Kovalevskaya being the first in modern times in 1874 [2]) or hold positions at universities (Sofya Kovalevskaya, again, being the first, though not the first to be offered a position). Even now, whenever a mathematician is casually named in a math course, this name is rarely a woman's. Most students in a Calculus course aren't hard-pressed to mention Newton or Euler or Gauss.

In honor of Women's History Month, I put together material to share with my students to show them some of the most important women in mathematics, divided into four sections for each week of Women's History Month. My hope is not only to give them examples of other women in mathematics, but to show them what progress we've made so far, through examples of the women who have helped make that progress possible.

1   Most Well-Known

In this section I gathered some of the names that students may have heard previously. I chose Hypatia (since many students may have seen the popular show *The Good Place*), Agnesi (for the curve named after her), Germaine (for her work in elasticity), Lovelace (for her algorithm), Kovalevskaya (for her theorem and the SK Days named for her), and Noether (who has a class of rings and popular theorems named after her).

1.1   Hypatia (370 - 415)

- Greek [3]

- Known for commentary on prominent mathematical works [12]

- Although other women are known to have studied mathematics in antiquity [3], her life is fairly well documented.

1.2   Maria Gaetana Agnesi (1718 - 1799)

- Italian [3]

- First woman to obtain a PhD in Mathematics [2]

- Appointed as a mathematics professor at a university, though she didn't accept [3]

- Wrote one of the earliest and most well-used textbooks on the differential and integral calculus, *Instituzioni analitiche ad uso della gioventù italiana* [11]

- The Witch of Agnesi is not actually created by her, but is named for her [11].

1.3   Sophie Germaine (1776 - 1831)

- French [3]

- She is known for work in elasticity, which was important in the construction of the Eiffel Tower, but her name is not on the list of contributors [3].

- Proved special cases of Fermat's Last Theorem [3]

1.4 Ada Lovelace (1815 - 1852)

- English [6]

- Published the first algorithm for Babbage's Analytical Machine (one of the first computers) [3]

- Known as "The Enchantress of Number" [6]

1.5 Sofya Kovalevskaya (1850 - 1891)

- Russian [2]

- First woman to take a position as math professor at a University [2]

- She was known for her work in analysis, differential equations, and mechanics [2].

1.6 Emmy Noether (1882 - 1935)

- German [16]

- Main contributions were in abstract algebra [16]

- Was an unpaid professor [16]

- Only woman with a portrait in 1964 World Fair in "Men of Modern Mathematics" [16]

2 Notable First PhDs

In this section, I noted some of the more notable first PhDs to help impress upon the idea of how long this progress took. It can, in ways, be debated who should appear first on this list since the requirements for obtaining a doctor of philosophy have changed over time.

2.1

Maria Gaetana Agnesi (1718 - 1799) was the first woman to earn a doctorate in mathematics [2].

2.2

Sofia Kovalevskaya (1850 - 1891) was the first woman in modern Europe to earn a doctorate in mathematics [2].

2.3

Euphemia Lofton Haynes (1890 - 1980) was the first African American woman to earn a doctorate in mathematics [10].

2.4

Both of these events occurred in 1980:

- Joséphine Guidy-Wandja (Ivory Coast) was the first African woman to earn a doctorate in mathematics. She was also the first African woman professor of mathematics at a university [8].

- Ruth Gonzalez was the first Hispanic woman to earn a doctorate in mathematics in the United States [14].

3   In Math Education

Women have also made considerable headway in working toward bettering math education and writing prominent texts. This section highlights three of those women.

3.1   Émilie du Châtelet (1706 - 1749)

- French [15]

- Worked with Voltaire on *Eleménts de la philosophie de Newton* [13]

- Translated and commentated on Newton's *Principia* containing laws of physics notably adding in the Leibnizian account of dynamics [15]

3.2   María Andrea Casamayor (1720 - 1780)

- Spanish [5]

- Published *Tyrocinio aritmético* and *El para sí solo* [5]

- Wrote under a male pseudonym [5]

- Her writing is known to show her deep care of educating the readers [5].

3.3   Wang Zhenyi (1768 - 1797)

- Chinese (Qing Dynasty) [4]

- She said about math- "There were times that I had to put down the pen and sighed. But I love the subject, I do not give up" [4].

- Published books known for explaining math more easily for beginners [4]

- She was skilled in many other areas, especially astronomy, showing that lunar eclipses occur when the moon passes behind the Earth [4].

4   More Recently

Closer to our current time, more women have emerged in the mathematical world. The founding of the Association for Women in Mathematics marks the need for, but also the ability to have, such an organization. Its mission statement is "The purpose of the Association for Women in Mathematics is to create a community in which women and girls can thrive in their mathematical endeavors, and to promote equitable opportunity and treatment of women and others of marginalized genders and gender identities across the mathematical sciences." The first and current president are listed here.

4.1   Grace Hopper (1906 - 1992)

- American [17]

- Mathematician, but more well-known for computer science work [17]

- Known for her part in creating COBOL [17]

4.2   Julia Robinson (1919 - 1985)

- American [1]

- Worked in Hilbert's 10th problem in (Diophantine Equations) where she helped show no algorithm to determine whether a Diophantine equation has any solutions in integers exists [1]

- First female mathematician to be elected to the National Academy of Sciences and the first female president of the American Mathematical Society [1]

4.3 Mary Gray (1938 -)

- First president of the Association for Women in Mathematics (AWM) [9]

4.4 Tabitha Washington (1974 -)

- Current President of AWM [7]

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