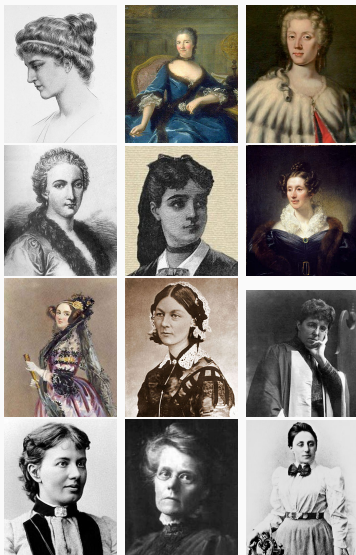# Women in Mathematics in the 1800s

Fall 2023 - R. L. Herman

Famous Women Mathematicians Before 1900

- Hypatia of Alexandria (c. 350-415)
- Émilie du Châtelet (1706-1749)
- Laura Bassi (1711-1788)
- Maria Agnesi (1718-1799)
- Sophie Germain (1776-1831)
- Mary Fairfax Somerville (1780-1872)
- Ada Lovelace (1815-1852)
  (Augusta Byron, Countess of Lovelace)
- Florence Nightingale (1820-1910)
- Charlotte Angas Scott (1848-1931)
- Sofia Kovalevskaya (1850-1891)
- Alicia Boole Stott (1860-1940)
- Amalie 'Emmy' Noether (1882-1935)

Émilie du Châtelet (1706-1749)

- Gabrielle-Émilie Le Tonnelier de Breteuil
- Father - official at the Court of Louis XIV at Versailles.
- Husband - Marquis Florent-Claude Chastellet, military man, governor of Semur-en-Auxois in Burgundy.
- Lovers: Pierre Louis Moreau de Maupertuis (1698-1759), Alexis Clairaut (1713-1765) and François-Marie Arouet (Voltaire) (1694-1778).
- Wrote on Newton, Leibniz, and the propagation of fire.
- Translation of the *Principia* into French.
- Debated Euler and others over *vis viva*, "living force," or kinetic energy $\Sigma m v^2$.
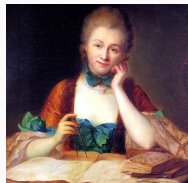

Figure 1: Émilie du Châtelet

Laura Bassi and Marie Agnessi

- Laura Bassi (1711-1788)
  - 1st female physics professor. Studied Newton, electricity.
  - Second in the world: Ph.D., 1732.
    - 1st - philosopher Elena Cornaro Piscopia, 1678.
  - First woman: doctorate in science.
- Maria Agnessi (1718-99).
  - First woman: mathematics handbook.
  - First woman appointed: mathematics professor.
  - First book on both differential and integral calculus
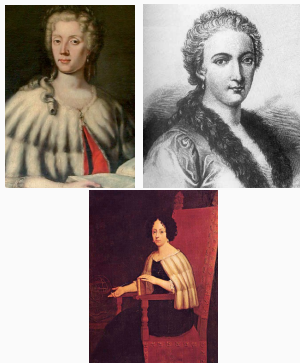 - Witch of Agnesi curve.

Figure 2: Bassi, Agnessi, Piscopia.

Marie Sophie Germain (1776-1831)

- Self-taught, French revolution
- 1794 - École Polytechnique opened
  - for men, obtained notes
  Signed HW - Monsieur Le Blanc
- Joseph-Louis Lagrange (1736-1813)
- Adrien-Marie Legendre (1752-1833)
- Gauss (1777-1855) - letters
  1804-12; saved his life.
- Germain Primes - If p is prime,
  then so is $2p + 1$ Ex: $5 = 2(2) + 1$,
  $7 = 2(3) + 1, 9 = 2(4) + 1$
- Elasticity work did not get her
  name on Eiffel Tower.

Figure 3: Sophie Germain

- Fermat's Last Theorem
- Chladni Plates, elasticity.
- Competitions 1811, 1813, 1815.

Mary Fairfax Somerville (1780-1872)

- Mathematics and astronomy
- Wrote books
- Jointly - the first female member of the Royal Astronomical Society with Caroline Herschel.
- First to sign petition to Parliament to give women the right to vote.
- experiments to explore the relationship between light and magnetism
- Translated/expanded Laplace's work, 1831, *The Mechanism of the Heavens*.
- First Geography text, 1848.

Figure 4: Mary Sommerville.

Ada Lovelace (1815-1852)

- Daughter of Lord Byron, (poet, died 1824) and
- Mathematician Anne Isabelle Milbanke, self-named as "princess of parallelograms."
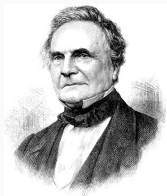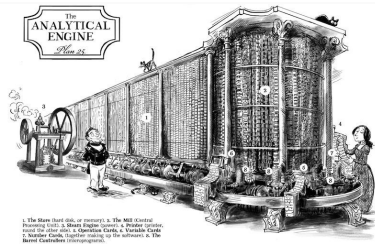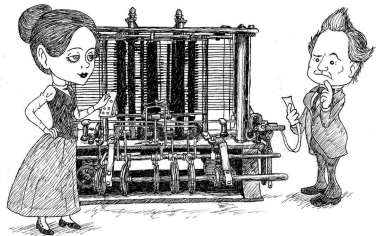- She wrote papers and first computer programs.

Figure 6: Augusta Ada Byron

Figure 5: Charles Babbage

Ada Lovelace and Charles Babbage

- Charles Babbage (1791-1881)
  - English mathematician, philosopher, engineer.
  - 1833 Difference Engine.
  - 1844 Analytical Engine.
  - Designed, never Built.
- Lovelace first algorithm for a machine.
- 1842-1843, Translated an article Luigi Menabrea on the engine. added notes containing first computer program.
- Loops, recursion - Bernoulli numbers, systems of linear equations.
- 1980's - Ada, programming language.

The ANALYTICAL ENGINE Plan 24.

1. The Store (hard disk, or memory). 2. The Mill (Central Processing Unit). 3. Steam Engine (power). 4. Printer (printer, read the other side). 5. Operation Cards. 6. Variable Cards. 7. Number Cards, (together making up the software). 8. The Barrel Controllers (microprograms).

Florence Nightingale (1820-1910)

- Crimean War (1853-1856)
- Supervised nurses.
- Studied under famous mathematicians.
- Used statistics - mortality rates
- Pioneer in data visualization, polar area diagrams.
- National heroine, 1883 recipient of the Royal Red Cross, and later others.

Figure 7: Florence Nightingale

Sofia Kovalevskaya (1850-1891)

- Born Sofya Vasilyevna Korvin-Krukovskaya in Moscow.
- Education in Europe.
- Teachers - Hermann von Helmholtz, Gustav Kirchhoff and Robert Bunsen.
- Advisor - Weierstrass (1874) - 3 papers PDEs, elliptic integrals, Saturn's rings.
- 1st woman to get doctorate in math outside Italy. - not enrolled! 1874.
- 1883 Teaching position, U. Stockholm.
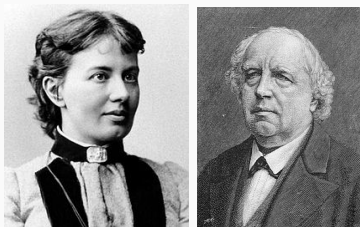- 1889 1st to hold chair in European university since Laura Bassi and Maria Agnessi.

Figure 8: Sofia Kovalevskaya and Karl Weierstrass (1815-1897)

Sofia Kovalevskaya (1850-1891)

- Light waves, tops, wrote books.
- 1886 - French Competition - spinning tops.
- 1889 - Swedish Academy of Science Prize Chebyshev got her membership in Imperial Academy of Sciences
- 1891 - On vacation, Influenza - pneumonia.
- Cauchy–Kovalevskya Theorem: local existence and uniqueness theorem for Cauchy problem in PDEs.
- Kowalevski top - a symmetric top with a particular ratio of the moments of inertia: $I_1 = I_2 = 2I_3$.

Figure 9: Sofia Kovalevskaya

Turn of Century - Charlotte Scott and Alicia Stott

Charlotte Angas Scott (1848-1931)

- One of 1st woman to obtain a doctorate in England.
- Studied under Arthur Cayley.
- Algebraic curves of degree higher than two.
- 1885 - 1st mathematician at Bryn Mawr College, dept head.
- A founder of AMS.

Alicia Boole Stott (1860-1940)

- Parents: George Boole (1815-1864) and Mary Everest Boole (1832-1916).
- Four-dimensional polytopes.
- Exactly six regular polytopes in four dimensions
- Worked with Harold Coxeter,(1907–2003).

Amalie 'Emmy' Noether (1882-1935)

- German mathematician
- Abstract algebra - theories of rings, fields, and algebras.
- Noether's theorem - connects symmetry and conservation laws.
- Mathematical Institute of Erlangen, 1908–1915 - without pay.
- University of Göttingen, 1915-1933, First four years lecturing under Hilbert's name.
- Bryn Mawr - 1933-5.
- Lectured at Institute for Advanced Study in Princeton.

Figure 10: Emmy Noether

That's *Not* All Folks! (Click on the Links)

- Ellen Amanda Hayes (1851-1930)

- Christine Ladd-Franklin (1847-1930)

- Elizaveta Fedorovna Litvinova (1845-1919)

- Ada Isabell Maddison (1869-1950)

- Helen Abbot Merrill (1864-1949)

- Mary Frances Winston Newson (1869-1959)

- Mary Emily Sinclair (1878-1955)

- Pauline Sperry (1885-1967)

- Anna Johnson Pell Wheeler (1883-1966)

- Grace Chisholm Young (1868-1944)