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Ada Byron King Lovelace

The field of mathematics has historically been dominated by men. However, when we analyse the history of mathematics, women have an exciting and impressive legacy. This historical 'blind spot' on the role of women is the result of the patriarchy and elitism within the processes of making history. Traditionally a woman's place was thought to be in the home, serving the role of a housewife. It is important to note that when women are mentioned in historical texts, it is because they have often been interesting adjuncts to the life of a famous man.[1] This poster seeks to explore two of these notable women in mathematics.

Figure 1: An image of "Ada Byron King Lovelace , 1838", by Nefi is licensed under CC BY-NC-SA 2.0 (© Creative Commons)

Ada Byron King Lovelace (1815-1852)

Considered the 'mother of computing', Ada Byron King Lovelace (1815-1852) made significant developments in mathematics in the early and middle parts of the 19th century. Augusta Ada Byron King Lovelace was primarily raised by her mother, who was also a mathematics student – as a result of this, Lovelace gained mathematical knowledge that was not available to girls at the time. She never actually attended university but had the opportunity to discuss her ideas and theories with famous mathematicians William Frend and Augustus De Morgan. She

[1] L. M. Osen, *Women in Mathematics*, (The MIT Press, 1974).

went on to marry the Earl of Lovelace, who was a Fellow of the Royal Society. Through her husband, Lovelace was able to gain access to books and papers she needed for her mathematical studies.[2]

Lovelace frequently visited Charles Babbage to discuss the Analytical Engine.[3] Babbage was impressed by Lovelace's mathematical skills and invited her to translate an article describing the Analytical Engine by Luigi Menabrea, an Italian Engineer. Her notes included the first algorithm intended to be processed by a machine and speculated the machine's ability to create graphics and complex music.[4] Lovelace described what jobs the Analytical Engine could do and noted that it could perform symbolic algebraic and arithmetic operations.[5] She was the first to print a computer program, which computed Bernoulli numbers, using them as the coefficients B_i in the expansion:

$$\frac{x}{e^x - 1} = 1 - \frac{x}{2} + B_2 \frac{x^2}{2} + B_4 \frac{x^4}{4!} + B_6 \frac{x^6}{6!} + \cdots$$

By using algebraic manipulation and the power series expansion for e^x, Lovelace also derived the equation:

$$0 = -\frac{1}{2}\frac{2n-1}{2n+1} + B_2\left(\frac{2n}{2!}\right) + B_4\left(\frac{2n(2n-1)(2n-2)}{4!}\right) + B_6\left(\frac{2n(2n-1)\ldots(2n-4)}{6!}\right) + \cdots + B_{2n}$$

From this, the values of B_i can be calculated recursively. Lovelace included basic concepts of modern-day programming in her description, such as loops and decision steps. Furthermore, she printed her notes with a detailed diagram of the program, which is believed to be the first-ever 'flowchart'.[6]

Lovelace's ideas and approaches are still used today, demonstrating her significant role in the development of mathematics, physics, and computing.

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[2] V. J. Katz, *A History of Mathematics*, (Pearson, 2014), p. 913.
[3] https://www.sciencefocus.com/future-technology/how-ada-lovelaces-notes-on-the-analytical-engine-created-the-first-computer-program/ (Science Focus, downloaded 7th December, 2020).
[4] https://www.theguardian.com/technology/2012/dec/10/ada-lovelace-honoured-google-doodle (Guardian Staff, downloaded 7th December, 2020).
[5] V. J. Katz, *A History of Mathematics*, (Pearson, 2014), p.915.
[6] Ibid., pp. 911-914.