# EMMY NOETHER

The 20th Century's Greatest Least Know Mathematician


## ABSTRACT

Founding some of the most fundamental aspects in modern mathematics and physics, why is she not more well known.  I uncover the dark and mysterious conspiracy surrounding her obscurity.



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Intro to Modern Mathematics

## Introduction

First, let me open this short summary on the life and work of a great mathematician with a bit about me. I had heard the name Emmy Noether before, and I knew she worked with Einstein. Or maybe Einstein thought she was smart? Did she do something with math or physics? Sherly she couldn't have that big of an impact or I would know more about her. It turns out that this is a sentiment shared by many men working in the fields of math and physics. Half of professionals in one survey haven't even heard of her. After reading about her accomplishments it became clear that the cause of her relative obscurity must be something else. After weeks of researching, meeting shady people in parking garages and trading state secrets with the Russians, I was able to uncover the deep insidious secret behind this mysterious conundrum… She was a woman in the early 20th century. _(:/)_/

## Personal Life

Noether was born in Erlangen, Germany on March 23[1], 1882 into a family of mathematicians. Her father and brother both had successes in this field. At the age of 18, Emmy decided that mathematics was something she wanted to pursue, instead of the more ladylike subjects of English, French and piano. Since she was barred from formally studying this at the University of Erlangen, she informally took all the mathematics courses and was so successful that in two years she earned an equivalent of a bachelor's degree. She continued her education by going to graduate school at the Universities of Göttingen in 1903 and Erlangen in 1907 where she earned her doctorate summa cum laude, the second woman to be awarded a doctorate.

Though she was a woman, she quickly gained the respect and admiration for most of the male colleges who had the opportunity to work with her. Many advocated to get her a position suitable for a person of her talent. For ten years, she was unable to get a post at a university. During this time she worked with her father and continued to publish papers. Eventually fellow mathematician David Hilbert was able to get her a position at the university of Göttingen as a "guest lecturer" in 1915. Hilbert had originally advocated for her to be brought on as an associate professor, but the university responded saying,

*"After all, we are a university, not a bathhouse." (Angier, 2012)*

After three years of working for the university for free, she was finally given a small salary, 13 years after earning her doctorates. She had success as a lecturer gaining a small but loyal group of followers known as Noether's boys. At Göttingen, she gained an interest in the study of mathematical invariance. When Albert Einstein published his theory of general relativity, the Göttingen math department became enthralled. It was at this time that Noether began applying the work she had done with mathematical invariances with general relativity resulting in the now famous Noether's Theorem.

Noether never went on to marry and continued to be one of the few female mathematicians to gain acceptance in the field during her lifetime. In 1932, she won the Ackermann-Teubner Memorial Prize in Mathematics.

1n 1933, Noether was one of the first Jewish scientists to be fired and force to flee Germany. Einstein was able to help her obtain a job at Bryn Mawr College where she was more accepted than she was in Germany. 18 months later, she was operated on for an ovarian cyst and died due to surgical complications on April 14, 1935.

[1] That's my birthday!!! What are the odds (probably 1 in 365.25).

## Impact on Physics and Mathematics

Emmy Noether is most know for two small contributions to the sciences: the development of the entire field of abstract algebra, and the development of Noether's Theorem, a fundamental tool of theoretical physicists.

In the lane of mathematics, Noether worked to generalize many of the approaches of algebra into its bare abstract components. The principals and concepts the resulted, ended up applying beyond algebra to unify the fields of topology, logic, geometry, algebra, and linear algebra (Radford, 2015). She did latter work with rings and her paper 'Idealtheorie in Ringbereichen (Theory of Ideals in Ring Domains)' became the founding document for commutative ring theory. She also would study non-commutative rings, representation theory(representing objects and transformations as matrices[2]), hyper-complex numbers(number systems that are neither real nor complex), and linear transformations. (Radford, 2015)

In Physics, she contributed Noether's Theorem.

$$\frac{\mathrm{d}}{\mathrm{d}t}\left[\sum_{i=1}^{n}\left(\frac{\partial L}{\partial \dot{q}_i}\mathrm{d}q_i\right)\right] = \mathrm{d}L$$

Where $L$ is the Lagrangian of a system, $q_1, q_2, \ldots, q_n$ are the coordinates of the system. I do not yet understand this in a mathematical sense at this time and it is appearing the time requirement needed for me to do so would exceed the time I have to finish this paper, so I will just explain what this means conceptually. Whenever a set of coordinates in a certain space is symmetrical, there is a conserved quantity associated with that quantity. If we say the properties of a system do not depend on where it is in space, we get conservation of linear momentum. If we say that rotating a system does not affect the physics, we get contribution of angular momentum. If we say the fundamentals of the space, we are working in do not depend on time, we get conservation of energy. And so on and so forth for whatever theoretical system you want to purpose.

[2] This is my best interpretation of this

## References

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