# Women in Mathematics:

From the unfathomed and unsounded discoveries of the different form of space to the farthermost expeditions reachable by imagination and logic, the history of mathematics has always been seen as an endeavour of men. Even today, it's no secret that male mathematicians still dominate the sphere. But this should not distract us from the radical contribution’s women have made in the field of mathematics. We have had and currently still have many notable women to thank for contemporary computations, revelations on the geometry of space, cornerstones of abstract algebra, and major advances in decision theory, number theory, and astronomy that still provide critical breakthroughs in applied areas like cryptography, computing, and physics.

March is National History Month for women and an honest time to excogitate in our readings, be it in our classrooms or personal one’s on the accomplishments and achievements of all those ladies in statistics, mathematics and all other fields of STEM. In 2001, the odds of female students taking the AP Calculus and AP Statistics Exams were 45.5 percent and 50 percent, respectively. This shows us that the inclusion and interest of ladies in STEM fields including mathematics is increasing day by day and not only that but are also solving complex mathematical problems that haven't been solved yet.

Today, I need to speak on a similar amazing female mathematician, a lady who believed in her capabilities and strength of character and her interest in mathematics, such a lot in order that she took on an issue from the set of tantalizing problems that were published by an infamous German mathematician by the name of mathematician. Starting with a basic introduction of Julia Robinson, an American mathematician who was born in Saint Louis, within the state of Missouri (United States of America) in 1919. Her full name was Julia Hall Bowman Robinson and also the daughter of Ralph Bowers Bowman and Helen (Hall) Bowman. She had a sister who like her was also a mathematically famous, genius and biographer, by the name of Constance Reid. Julia Robinson’s family moved to Arizona and so to metropolis when the ladies were some years old. Julia attended metropolis High. She entered metropolis State University in 1936 and transferred as a senior to college of California, Berkeley, in 1939. In 1940 she received her bachelor’s degree and continued in graduate studies. She received the Ph.D. degree in 1948 under Alfred Tarski with a dissertation on "Definability and Decision Problems in Arithmetic". In 1975 she became a professor at Berkeley, teaching quarter-time because she still didn't feel strong enough for a full-time job.

Now coming to the her amazing discovery, that is the solution of the German mathematicians 10th problem, a little history on it is that Julia would discuss the curiosity she felt every day of her life as the Hilbert’s problem remain unsolved, blowing out candles on every birthday of hers with only one wish and that was to find and deduce the solution of that problem. Her wish came true when Mr. Yuri Matiyasevich a Soviet mathematician announced close to her 50th birthday that he had found the solution to the last missing piece of the puzzle. This was in the early 1970’s Matiyasevich was 22 years old, born round the time Robinson had started brooding about the 10th problem. Though the 2 had not yet met, she wrote to Matiyasevich shortly after learning of his solution, “I am especially pleased to think that once I first made the conjecture you were a baby and that I just had to attend for you to grow up!”

The conjecture Robinson was pertaining to was one among her contributions to the answer to Hilbert’s 10th problem. Robinson and two other American mathematicians did important and crucial work that led Yuri Matiyasevich there. Despite the three weeks it took for his or her letters to succeed in one another, Robinson and Matiyasevich started working together through the mail within the fall of 1970. “The name of Julia Robinson can't be separated from Hilbert’s 10th problem,” Matiyasevich wrote in a piece of writing about their collaboration.

Robinson was the primary woman to be elected to the mathematics section of the National Academy of Sciences, the primary woman to function president of the American Mathematical Society and a recipient of a MacArthur Fellowship. She achieved all of this despite not being granted a politician faculty position until a few decades before her death in 1985.

Describing the 10th problem a little, the 10th problem is a deep question about the limitations of our mathematical knowledge, though initially it looks like a more straightforward problem in number theory. It concerns expressions known as Diophantine equations. Named for Diophantus of Alexandria, a third century Hellenistic mathematician who studied equations of this form in his treatise Arithmetical, a Diophantine equation is a polynomial equation with any number of variables and with coefficients that are all integers. (An integer is a whole number, whether positive, negative or zero.)

Examples of Diophantine equations include everything from simple linear equations such as 5x+y=7 (the variables are x and y, and their coefficients are 5 and 1) to the Pythagorean distance formula a2+b2=c2 (the variables are a, b and c, and their coefficients are all 1) to towering monstrosities in googols of variables.

Mathematicians are interested in whether Diophantine equations have solutions that are also integers. For example, Pythagorean triples — sets of numbers such as 3, 4 and 5 or 5, 12 and 13 — are solutions to the equation a2+b2=c2. Some Diophantine equations have integer solutions, and some do not. While a2+b2=c2 has infinitely many integer solutions, the similar equation a3+b3=c3 has none (except for solutions including zeros, which mathematicians consider uninteresting).

If an equation does have integer solutions, you do not need to be particularly clever to find them — you just need to be patient. A brute-force search will eventually give you numbers that work. (Of course, being cleverer may mean you can be less patient.) But if you do not know whether the equation can be solved in integers, you will never know whether your failure to find a solution is because none exists or because you have not been patient enough.

Coming back to the life of Julia Robinson outside of the 10th problem, Julia had won many honours for her hard work and profession, some of which include United States National Academy of Sciences elected 1975 (first woman mathematician elected); Noether Lecturer 1982; MacArthur Fellowship 1983; President of American Mathematical Society 1983–1984 (first woman president); Fellow of the American Academy of Arts and Sciences 1985; The Julia Robinson Mathematics Festival sponsored by the American Institute of Mathematics 2013-present and by the Mathematical Sciences Research Institute, 2007–2013, was named in her honour.

In a Mathematical Association of America article, “The Autobiography of Julia Robinson”, her sister and biographer Constance Read wrote, “She herself, within the normal course of events, would never have considered recounting the story of her own life. As far as she was concerned, what she had done mathematically was all that was significant.”

A year after Robinson's death, her husband founded the Julia B Robinson Fellowship Fund to produce fellowships for graduate students in mathematics at Berkeley. When Raphael Robinson died in January 1995 the majority his estate went into the Fellowship Fund.

References:

AP Central. 2020. *Women's History: Women In Mathematics | AP Central — The College Board*. [online] Available at: <https://apcentral.collegeboard.org/courses/resources/womens-history-women-in-mathematics> [Accessed 13 April 2020].

Carr, A., 2020. *3 Revolutionary Women Of Mathematics*. [online] Scientific American Blog Network. Available at: <https://blogs.scientificamerican.com/guest-blog/3-revolutionary-women-of-mathematics/> [Accessed 14 April 2020].

Math.unl.edu. 2020. *Julia Robinson*. [online] Available at: <http://www.math.unl.edu/~awm/awm\_folder/NoetherBrochure/Robinson82.html> [Accessed 14 April 2020].

Mathshistory.st-andrews.ac.uk. 2020. *Julia Bowman Robinson (1919 - 1985)*. [online] Available at: <http://mathshistory.st-andrews.ac.uk/Biographies/Robinson\_Julia.html> [Accessed 14 April 2020].

Msri.org. 2020. *Mathematical Sciences Research Institute*. [online] Available at: <https://www.msri.org/web/msri/education/for-k-12-educators/julia-robinson-math-festival> [Accessed 14 April 2020].

Science News. 2020. *How Julia Robinson Helped Define The Limits Of Mathematical Knowledge*. [online] Available at: <https://www.sciencenews.org/article/how-julia-robinson-helped-define-limits-mathematical-knowledge> [Accessed 14 April 2020].

Scientificwomen.net. 2020. *Julia ROBINSON*. [online] Available at: <https://scientificwomen.net/women/robinson-julia-84> [Accessed 13 April 2020].

ThoughtCo. 2020. *11 Amazing Women In Mathematics History*. [online] Available at: <https://www.thoughtco.com/women-in-mathematics-history-3530363> [Accessed 14 April 2020].

Www2.stetson.edu. 2020. *Julia Bowman Robinson*. [online] Available at: <https://www2.stetson.edu/~efriedma/periodictable/html/Rb.html> [Accessed 13 April 2020].