

Galois – Boy Genius, Great Mathematician, Poor Dueler

French Mathematician: Born Oct 25, 1811 – Died May 30, 1832

Evariste Galois left a legacy that grew out of trying to solve a type of equation. Galois maternal grandfather was a jurist at the Faculty of Law, and his father and paternal grandfather were headmasters of a school. There were no mathematicians in the family, but Galois showed early promise in this. His mother was his only teacher until he was twelve. In 1823 he was enrolled as a boarder at the Lycee of Louis-le-Grand in Paris. This was a famous preparatory school which had alumni such as Robespierre and Victor Hugo.

Galois had a great two years, but got bored in his third year and had to repeat it. While repeating this third year, he took his first course in mathematics, and he took off. He devoured Legendre's Book on Geometry. In fact, he got so engulfed in mathematics, he neglected some of his other work. Galois, was not very good at listening to advice about building up his overall mathematics ability, and when he took the entrance examination for the prestigious l'Ecole Polytechnique, he failed.

Under a teacher named Louis Paul Emile Richard, he started to learn his gaps in mathematics. Richard asked the Polytechnique to waive his entrance exam, but was turned down. In reply, Galois published a paper on continued fractions, *Annales des mathematiques*, in 1829, at the age of 17! Now a series of setbacks for Galois, none of them his fault, caused much of troubles that he encountered over the next two years. First, his Father was accused of a scandal and he committed suicide in 1830. Galois failed again, the entrance exam to l'Ecole Polytechnique and enrolled instead in l'Ecole Normale, a training school for secondary teachers. His paper, to be reviewed by the great mathematician, Cauchy, was put aside and not submitted in time. Cauchy suggested some revisions for Galois and that it be submitted for a Grand Prize in Mathematics to another mathematician, Fourier. However, Fourier died in April 1830, and there is no record that Galois' paper was ever passed on.

Meanwhile, France was alive with revolution fever, and Galois joined the Society of Friends of the People, a group that sought the abolishment of the monarchy altogether. Galois left L'Ecole and joined the Artillery of the National Guard, an anti-monarchist branch of the militia. A royal decree abolished the National Guard. Galois then decided to offer a weekly mathematics course. They met for the first time on January 13, 1831, with about 40 students, and only met a few times. Some of Galois' friends in the Artillery of the National Guard were on trial and acquitted in April of 1831. Galois and other supporters organized a celebration banquet. Galois was charged with making a toast, against the king, but was acquitted. However, anti-monarchy demonstrations soon had in back in jail, and in the dungeon. While in jail, he found out that his latest manuscript had been rejected, for the judges could not follow his logic.

On his release, Galois carried on with his new mathematical work. There were many mathematicians trying to find a solution to the quintic equation. These are equations containing a fifth power such as $3x^5 - 2x^4 + 5x - 7 = 0$. The Norwegian mathematician, Niels Henrik Abel, thought he had a solution, but soon found a flaw in his work. Galois worked on a more general idea and began a whole new branch of mathematics called Group Theory. Through this, Galois was able to prove that it was impossible to find a solution using radicals for all polynomial equations of degree greater than 4. Galois was released from prison on April 29, 1832.

At this time, there is much speculation to what happened over the next month. Galois was challenged to a duel by Pescheux d'Herbinville. In a book, *The Equation that Couldn't Be Solved: How Mathematical Genius Discovered the Language of Symmetry, by Mario Livio*, the duel was between pistols, but I have also seen that it was with swords. That night, Galois wrote out his whole ideas of Group Theory and the proof of the insolvability with radicals of the quintic equation. The following morning he was killed in the duel at the age of twenty. A decade later, the French mathematician Joseph Liouville submitted his work, and finally the world saw the genius of this man. The branch of group theory is sometimes called Galois Theory in his honour. Imagine what he could have contributed if he had lived a normal life span.

The information for this came from the Stephen Hawking's book, *God Created the Integers*.