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The mysteries on stupid Galois death

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Abstract
Évariste Galois, who died in his youth in a duel, is known as one of the greatest mathematicians of all time. Biographers Galois report a tragic and adventurous life, which contains ingredients to a story that certainly would give to write a novel. His theory provided a solution to the question of determining when radicals can solve an algebraic equation. With the formulation of the theory of groups, Évariste Galois changed the mathematics because, given the possibility of opening a promising new front of research, however, died before his work was recognized.

Keywords: Galois, mathematics, group theory.

Introduction

The Mathematics books contain references to personalities of all times this science, such as Pythagoras, Euclid, Thales, Descartes, Newton, Leibniz, Pascal, Gauss, Bernoulli, Poisson, among other geniuses.

However, there were others whose genius was almost forgotten. In this article, we reveal aspects of the brief biography of one of those who is not always remembered, Évariste Galois. Information from its traditional family, his student days, his relationship with women and so on.

Some questions about his life are obscure, for example, Galois was even a young anarchist? What is the contribution of a possible lover, Stephanie, in the episode that resulted in his premature death?

Some details his life presented by his biographers, have a strange episode that occurred when he was hospitalized, being treated by a doctor who was the father of his beloved one. For some of these reasons, say the biographers, the story of Galois deserves to be known and remembered not only by mathematicians, but also for all men.

TUMELERO and MUSIAL (2009) [12] report that Évariste Galois was born in Bourg-la-Reine, France on October 25, 1811. He was the son of Nicolas Gabriel Galois, an important citizen of Paris, educated man, lover of philosophy and freedom, which has earned the respect of the community.

In 1815, during the rule of the Hundred Days, which followed Napoleon's escape from Elba, his father was elected mayor of Bourg-la-Reine. His mother, Marie Adélaide Demante, descended from a family of lawyers, was a generous woman with strong character and independent thinking, being responsible for your child's education until the age of 11. Therefore, Galois was educated at home by her mother who, besides the usual education, received good training in Greek, Latin and religious teachings. Only in 1823, he entered the Royal College of Louis-le-Grand.

According DIEGUEZ (2004) [5], Galois is known as one of the greatest mathematicians of all time, who died in his youth in a duel. His mathematical ability emerged when, under the guidance of Louis Richard, began to study the works of his fellow Adrien Marie Legendre on geometry and Joseph Louis Lagrange in algebra.

Together with his advisor, he made a further study on the issue of solving algebraic equations. His theory provided a solution to the question of determining when radicals can solve an algebraic equation. For a long time, mathematicians have used explicit formulas involving only rational operations and root extractions, for the solution of equations of degree four, but could not solve the degree five or higher equations. The elucidation of this problem and with the development of group theory, Évariste Galois changed the mathematics, but died before his work was recognized. For full details of his work, it is recommend the reading of the book *"As paixões proibidas do anarquista Évariste Galois"* (TN: *"The prohibited passions of anarchist Évariste Galois"*) by A.P. RICIERI (1988) [10], from which wealth of information were extracted.

Years Rebels

From the age of 12, Galois life begins to change, because at the time of his adolescence, France went through a period of great social and political unrest. Immediately, he put himself at the center of many controversies, which not only removed him from his brilliant career, but also eventually led him to a premature death.

When entering the fourth grade at the Lycee Louis-le-Grand, in the first month, he found that the students were treated unfairly by the school. With his explosive temperament and, in a way to hasty, he was in charge to defend the colleagues, farming, thus enmities with their tutors and shaking the student life of disciplined students of the Lyceum.

As noted in the text by RICIERI [10] (1988), the height of the "rebellion" of Galois began in 1829, with the unexpected suicide of his father, Nicholas Galois, after disagreements with monarchists and clerical enemies. Napoleon Bonaparte had been overthrown and then the monarchy was restored in France with King Charles X. At this time, both father and son declared themselves Republicans and they were not well regarded by government agents. Évariste, now a student at the *"École Normale Supérieure"*, had as its favorite game, debauchery to the king. The revolution of July 1930 overthrew the monarch Charles X and crowned King Louis Philippe. On Philip's possession, Évariste began his political activist

career, commanding an outage of classes in your school, to participate in demonstrations against the king.
Continuing his protests, he wrote an article which expressed his republican pro reviews, why was immediately expelled from the *"École Normale Supérieure"*.
The day commemorating the storming of the Bastille, Galois marched in Paris, wearing the uniform of the former Guard Artillery, waving and making the public provocation to the government. His successive political demonstrations, led him to prison twice. In the first one, he was acquitted, but in the second, he spent six months in prison on charges of treason. The Court of Appeal confirmed the sentence on December 31, 1931. Reportedly, that detention center was synonymous with hell, given the filth, promiscuity and there found repression. However, worse than his luck in politics, just right at the Academy of Sciences.
At sixteen he could make his first exclusive math course. Quickly, he absorbed the most modern concepts and, at the age of seventeen, published his first paper in *"Annales de Gergonne"*.
Among his 16 and 18, he tried unsuccessfully to enter the Polytechnic School, which circulated the leading French mathematicians of the time. The Academy of Sciences lost twice the report with the Galois discoveries and, when placed his hand in the third version, rebuked the boy. The examiners did not understand his ideas and did not believe in the recorded results, doubting his ability, repeatedly reproaching him then (GAUTIER 2003) [8]

A Dangerous Passion

There was a clear path to the young prodigy; however, its brightness would be the greatest obstacle to their progress. Moreover, the young genius did not improve the situation with his explosive temper and a rainfall that only conquered the enmity of his tutors and everyone who crossed his path.
Biographers of Galois report a tragic and adventurous life, which contains ingredients to a story that certainly would give to write a novel. Drinks, women, anarchism, politics and mathematics, a diabolical mixture. Although it is not known how the case began, the details of the final tragedy are well documented NASCIMENTO (1999) [9].
In early 1832, in prison, the depressed state of the Galois lead to psychological chaos, therefore, to complete the tragedy, it was one of the victims of a cholera epidemic. In March, he released from prison to treatment, cured of this disease, but contracted "other", since; fell in love with STEPHANIE, doctor's daughter, who was committed to a citizen named D'HERBINVILLE.
What happened to Galois in the weeks after meeting with Stéphanie is the subject of much speculation, but what is known for sure is that the novel did not have a happy conclusion.
D'Herbinville, one of the best shooters of France, protagonist of about twenty duels victorious, did not hesitate to challenge Galois. So on the morning of May 30, 1832, Galois, under 21, was defending his honor, died because of the duel.
TUFFANI (2001) [13] comments that the circumstances that led to the death of Galois were not entirely clear, therefore remaining few details of French tragedy. Apparently, the Galois own left clues indicating that this was a political plot to eliminate him and some of his friends released a version that "the groom betrayed" was a government agent.
In the plot, Stéphanie would have been just a bait used to lure you and cause discord. Specifically, it is known that the night before the duel, Galois wrote hastily a letter to his friend Auguste Chevalier, which summed up his scientific work and included some new theorems and conjectures. He died without knowing that your article with 60 pages of scribbles and doodles would be considered one of the foundations of modern mathematics.

The Work of Galois

To learn in detail about the work of Galois, we indicate the text TEIXEIRA and MARTINS (2006) [11]. In 1823, at the College Louis-le-Grand in Paris, Galois studied the treaties of Legendre and Lagrange. In 1828, he took the exam for entry to the main University of Paris, the *"Ecole Polytechnique"*. However, he failed. Also in Louis-le-Grand and the support of his teacher Emile Richard, Galois published in April 1829, its first article, entitled Demonstration of a theorem about periodic continued fractions. That same year, Galois submitted his research on solving algebraic equations for the *"Academie des Sciences"*. The renowned mathematician Cauchy was appointed reviewer of this article, but was not interested, because, it seems, the document was lost.
In 1830, Galois published three articles at the leading scientific journal of France, the Bulletin of Mathematical Sciences, Physical and Chemical. The articles were Resolutions algebraic equations, Notes on the resolution of numerical equations and notes on the theory of numbers (BROLEZZI 2009) [4]
It can be said that in these articles, Galois developed a work that establishes radicals can solve the solubility conditions for a degree of any algebraic equation. His method was to analyze the permutations of the roots of the equation.
According to BOYER (1974) [2], the main objective of Galois research was to determine when the polynomial equations are solvable by radicals. Gauss, in his criteria for constructability of regular polygons, had resolved the issue of solubility of the equation in terms of rational operations and square roots of the coefficients. Galois generalized the result by providing criteria for the solvability of the type equations

$$a_n xn + a_{n-1} xn-1 \ldots\ldots + a_3 x^3 + a_2 x^2 + a_1 x + a_o = 0$$

In terms of rational operations and nth roots of coefficients. His method of attack the problem, now called Galois Theory.
The publication and recognition of Galois work and ideas occurred through the history of October and November 1846 in the Journal of *"Mathématique Pures et appliquées"*, Joseph Liouville, fifteen years after his death, where the hypotheses and assumptions of the theory are prepared groups (NASCIMENTO, 1999) [9].
These articles contained as innovative and sophisticated solutions that their teachers could not judge them correctly.
Some of his ideas were forwarded by letter, to his friend August Chevalier, with the following words,

"My Dear Friend,

I have made some new discoveries in analysis. The first concerns the theory of equations, the others integral functions. In the theory of equations, I have researched the conditions for the solvability of equations by radicals; this has given me the occasion to deepen this theory and describe all the transformations possible on an equation even though it is not

solvable by radicals. All this will be found here in three memoirs." [...] and it would not be in my interest to leave myself open to the suspicion that I announce theorems of which I do not have a complete proof.
Make a public request of Jacobi and Gauss to give their opinions, nota as to the truth, but as to the importance of these theorems. After that, I hope some way find it profitable to sort out this mess.

I embrace you with effusion, E. Galois."

Final Considerations

Remember and reflect on the contributions of Évariste Galois is, first, an act of deep respect and admiration for mathematics education. He saw the world through the readings he had built. He was a man who dared to break with the political administrative system, refused to be a mere spectator of the struggles of his people and, knowing draw lessons from the tragedy changed the history of mathematics with some brilliant contributions. The torments of his soul, they added up questions such as: Why are so many inequalities between men? Who says it has to be?

I would repeat a text RICIERI [10] entitled *"Quando se morre aos vinte"* (TN: *"When one dies at twenty"*):

"It is often considered the great mathematicians as intrepid thinkers who, in search of truth, limit their lives to the study of indecipherable formulas, at least for most of us. Dedication, ingenuity, honesty and abstinence are attributes to these myths. The stories of Abel and Galois counter this stereotype and therefore fascinate and involve. An impartial assessment, it is concluded that both would have easily won their ideals to repress the impetuous behavior dictated by his conscience anarchic, exalted by outbursts of freedom. They did not, however, and paid for his mistakes with life."

During his life, this young mathematician had the opportunity to meet some of the most important of his time scientific men, however, despite fight hard, was not recognized.

At 17 years old, he had already made several demonstrations and revolutionary propositions that it's guiding thought so different from their own ideas that did not accept. Undeterred, Galois sent copies of their work to other scientists and friends.

Despite his devotion to the republican cause and his romantic involvement, Galois had kept his passion for mathematics. One of his greatest fears was that his research, rejected by the Academy, was lost forever (EVES [6], 1995).

Finally, after a long time, his articles have been published in the prestigious *"Journal de Mathématiques Pures et Appliquées"*. The mathematicians' response was immediate, ensuring that Galois [7] had in fact made a full explanation of how it could get to solutions of the fifth degree equations.

Around 1842, his work was posthumously published. Thus, twelve years after his death, the drafts, from that it was his last night, were examined. A surprise, therefore its complex group theory opened a completely new field for algebra. His genius and merits of his work were recognized. The discovery of group theory gave mathematicians the possibility of opening a new and promising line of research. Something that in the next century would be critical to the development of computers, for example.

Science teaching standpoint, BRAZ, and GUTIERRE (2009) [3], mention the realization of a play whose script was the chapter "The tragedies of Niels Abel and Évariste Galois" the book "The Romance of Algebraic Equations". The objectives of this action, promoted by extension project were twofold. First, test whether the choice of the play or not critical to student motivation in mathematics discipline. Subsequently, the fact of knowing the life stories of Abel and Galois improves academic performance of the student, from the moment, that these students realize through the History of Science, which their ancestors also made mistakes, hesitated, dated studied, and became ill.

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