

Évariste Galois

Évariste Galois (pronounced 'Gaalvaa') was born on October 25, 1811 in the town of Bourg-la-Reine, France, to Nicolas-Gabriel Galois and Adelaide-Marie Demante.

Nicolas-Gabriel Galois was the chief of the town's liberal party, which owed allegiance to Napoleon, and he directed a school accommodating about sixty boarders. During the 'Hundred Days' rule of Napoleon in 1815, in the middle of the reign of Louis XVIII, Nicolas-Gabriel was elected Mayor of Bourg-la-Reine. When the allies seized power back from Napoleon and reinstated Louis as King he wanted to relinquish his post to his predecessor, but the latter had left the country. So he continued in his post and served the new King faithfully, but in the process seems to have met increasing resistance from both sides, liberals and royalists.

Adelaide-Marie Demante was from a family of jurists and had received a traditional education. Évariste had an elder sister Nathalie-Theodore and a brother Alfred. It was a close knit family and Évariste's childhood seems to have been happy and studious. Évariste was taught by his mother till he was twelve and was given a solid background in Greek and Latin.

He was enrolled in the Lycee (secondary school) of Louis-le-Grand in Paris as a fourth-form boarder in October 1823. Coming from a liberal atmosphere at home he found it difficult to submit to the harsh discipline during the troubled times following the second restoration of Louis XVIII which culminated in the 'July Revolution' in 1830. During his first term, the students who suspected the school authorities of planning to bring back the conservative Jesuits to the school, protested and staged a minor rebellion; they refused to sing at the chapel when asked to do so and also refused to toast the King at an official school banquet. The authorities retaliated by summarily expelling the forty students who were suspected to be primarily responsible; Évariste was not among those expelled but the incident might have had a strong impression on him, strengthening the liberal ideas he had imbibed at home and developing a dislike for authority.

He was considered a brilliant student although his mathematical talents were still dormant and he started on his first mathematics course only in 1827. He received a prize in the General Concourse. The typical comments about him during his first years at Louis-le-Grand had been: *Religious Duties*: Good; *Conduct*: Good; *Disposition*: Happy; *Work*: Sustained; *Progress*: Marked; *Character*: Good, but singular.

In February 1827 he started attending mathematics courses taught by HJ Vernier. The first contact with mathematics was a revelation to him but he soon became tired of the elementary nature of the course and the deficiencies in the textbooks. He discovered Legendre's classic on geometry and then went on to reading the original works of Lagrange. Lagrange had devoted much time and effort on the question of solvability of equations by radicals and on elliptic integrals. Galois was attracted by these two problems in particular and he was to solve completely the problem of solvability by radicals while making important contributions to the theory of elliptic integrals. As could be expected, once he discovered mathematics, Galois completely lost himself in it and neglected his other courses. At the end of the first

trimester (in Vernier's class) his teacher's remarks about him changed to: *Religious Duties*: Good; *Conduct*: Passable; *Disposition*: Happy; *Work*: Inconstant; *Progress*: Not very satisfactory; *Character*: Closed and original.

Not heeding the advice of Vernier, who implored him to work more systematically, Galois took the entrance examination to *l'Ecole Polytechnique* a year earlier without the usual special course in mathematics; and he failed. This was a blow to Galois but he immediately enrolled in the course of Louis-Paul-Emile Richard, a well known teacher of mathematics. Richard became aware of Galois's special abilities in mathematics and even recommended that Galois be admitted to the Polytechnique without any examination.

Buoyed by the encouragement he got, Galois published his first paper 'Demonstration d'un theoreme sur les fractions continues periodique' in the *Annales de Gergonne*, XIX (1828–29), pp 294. But this was only a minor aside. On May 25 and June 1, 1829, Galois, not yet 18, submitted to the Academie des Sciences his work on the solvability of equations of prime degree. Cauchy was assigned by the Academy to report on Galois's memoirs; under his counsel Galois was to revise his paper taking into account the work of Abel. Galois accepted the suggestions and submitted a revised manuscript. Cauchy was planning to report it at the Academy on January 18, 1830 but could not attend the session because of indisposition; he had requested postponement but in the next session on January 25 he did not present Galois's paper. The guess is that Cauchy had suggested to Galois that he combine all his results into a single paper and submit it for the *Grand Prix* in mathematics which Galois eventually did in February. The paper went to Fourier who was appointed to examine it. But misfortune struck in the form of Fourier's death in April 1830; and the competition was held and prize was given without the participation of young Galois.

There were tragedies on the personal front as well. Galois's father committed suicide on July 2, 1829 unable to bear the malicious campaign launched against him by the reactionary priest of Bourg-la-Reine. When the priest attempted to attend the funeral a minor riot erupted. A few days later Galois failed in his second and last attempt at the entrance examination for *l'Ecole Polytechnique*.

Bewildered by misfortunes striking one after the other, and denied chance to pursue his beloved mathematics, Galois believed himself to be the object of persecution by the Academy and society in general.

Failing to get into *l'Ecole Polytechnique*, he took the entrance examination to *Ecole Normale Superieure* which trained secondary school teachers. He was admitted because of his excellent grades in mathematics and physics and he entered this institution in November 1829. He also received his *Bachelor of Letters* and *Bachelor of Science* on December 29, 1829.

Then came the *July Revolution* in July 1830. The students were prevented from participating in the revolution by the Director of *Ecole Normale*, M Guigniault who after the events immediately changed sides. Galois exposed his Director's hypocrisy in a blistering letter to a newspaper which resulted in

Galois being expelled from the school in December that year. Thrown out of the school, he joined the Artillery of National Guards which was abolished by a royal decree in fear of its threat to the throne on December 31, 1830. The 'July Revolution' resulted in the replacement of Louis XVIII as King by Louis-Phillipe.

Out of school, in January 1831, Galois attempted to organise a private class in mathematics which attracted about forty students. But, deeply involved in political activities, Galois could not sustain this for long. In the same month, on an invitation from Poisson, Galois submitted a third version of his paper.

On May 9, 1831 a banquet was organised by Republicans to celebrate the acquittal of the nineteen republicans who had been tried on conspiracy charges. The atmosphere at the banquet was defiant and revolutionary. Galois held an open dagger in one hand and a glass in the other and rose to propose a toast to Louis-Phillipe. (This incident is recounted by Alexander Dumas, who was Galois's contemporary, in his *Mes Memoires*, Paris: Editions Gallimard, 1967.) Galois was arrested at his mother's house on the following day but at the trial, moved by his youth, the jury acquitted him. Soon after he received the rejection of his paper from the academy; Poisson who examined the paper is quoted in the letter: 'We have made every effort to understand M. Galois's proofs. His argument is neither sufficiently clear nor sufficiently developed to allow us to judge its rigor; it is not even possible for us to give an idea of this paper... .'

Galois was arrested again on the *Bastille Day*, July 14, 1831 along with one of his republican friends for wearing the uniform of the National Guard (which had been disbanded in December 1830) and for being heavily armed. The charges were confirmed and he was given a prison sentence and lodged in Sainte-Pelagie prison. Here Galois attempted suicide once and was saved. While in the prison, giving up all plans to publish his papers through the academy, Galois decided to publish them privately with the help of his friend Auguste Chevallier. He remained in Sainte-Pelagie till March 16, 1832 when he was transferred to the pension Sieur Faultrier along with other prisoners to prevent them from being exposed to the cholera epidemic that was sweeping Paris. He was released on April 29, 1832.

The later events of his life are hazy. He seems to have got involved in a love affair with Stephanie Dumotel, daughter of a resident physician at Sieur Faultrier. He was provoked into a duel under unclear circumstances with a fellow republican Pesheux d'Herbinville (who was one of the nineteen republicans who had been tried on conspiracy charges and acquitted). He seems to have been forced to keep the duel a secret from his friends who may have helped in preventing the duel. The duel took place on the morning of May 30, 1832 near a pond in the vicinity of the pension Sieur Faultrier and Galois was shot through the stomach. He was seriously injured and was lying unattended when he was found by a passing peasant. His family was informed and he was taken to a hospital where he died in the arms of his brother Alfred on May 31, 1832.

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