Ferro (or Ferreo, Dal Ferro, Del Ferro), Scipione | Encyclopedia.com

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(*b*. Bologna, Italy, 6 February 1465; *d*. Bologna, between 29 October and 16 November 1526)

mathematics.

Scipione was the son of Floriano Ferro (a paper maker by trade) and his wife, Filippa. He was a lecturer in arithmetic and geometry at the University of Bologna from 1496 to 1526, except for a brief stay in Venice during the last year. In 1513 he is recorded as an "arithmetician" by Giovanni Filoteo Achillini, in the poem *Viridario*. After Scipione's death, the same subjects were taught by his disciple, Annibale dalla Nave (or della Nave). Nave married Scipione's daughter, Filippa, and inherited his father-in-law's surname, thereby calling himself dalla Nave, alias dal Ferro. Scipione's activity as a businessman is demonstrated by various notarial documents from the years 1517-1523.

No work of Scipione's either printed or in manuscript, is known. It is known from several sources, however, that he was a great algebraist. We are indebted to him for the solution of third-degree, or cubic, equations, which had been sought since antiquity. As late as the end of the fifteenth century, Luca Pacioli judged it "impossible" by the methods known at that time (Summa, I, dist. VIII, tractate 5). Scipione achieved his solution in the first or second decade of the sixteenth century, as is known from the texts of Tartaglia and Cardano. He did not print any account of his discovery, but divulged it to various people and expounded it in a manuscript that came into the possession of Nave, but which today is unknown.

In 1535 a disciple of Scipione, named Antonio Maria Fiore, in a mathematical diapute with Tartaglia proposed some problems leading to cubic equations lacking the second-degree term, of which he claimed to know the method of solution, having learned "such a secret," thirty years before, from a certain "great mathematician" (Tartaglia, *Quesiti*, bk. ix, question 25). Tartaglia (who had concerned himself with cubic equations as early as 1530) was now (1535) induced to seek and find the solution to them. Some years later, yielding to entreaties, he communicated his solution to Cardano (1539).

Still later (1542), in Bologna, Nave made known to Cardano the existence of the aforementioned manuscript by Scipione: this is attested by Ludovico Ferrari, Cardano's famous disciple, who was with the master (Ferrari to Tartaglia, *Secondo cartello*, p. 3; see also Tartaglia to Ferrari, *Seconds risposta*, p. 6). Cardano, who published the *Ars magna* (1545) somewhat later, represented the solution of cubic equations as the distinguished discovery of Scipione and Tartalia. The following is taken from the *Ars magna* (chs. 1, 11);

Scipione Ferro of Bologna, almost thirty years ago, discovered the soluction of the cube and of things equal in number [that is, the equation $x^3 + px = q$, where p and q are positive numbers], a really beautiful and admirable accomplishment. In distinction this discovery surpassess all mortal ingenuity and all human subtlety. It is truly a gift from heaven, although at the same time a proof of the power of reason, and so illustrious that whoever attains it may believe himself capable of solving any problem. In emulation of him Niccolò Tartaglia of Brescia, a friend of ours, in order not to be conquered when he entered into competition with a disciple of Ferro, Antinio Maria Fiore, came upon the same solution, and revelaed it to me because of my many entreaties to him.

The coincidence of Scipione's and Tartaglia's rules was confirmed by Ettore Bortorlotti by means of an ancient manuscript (MS 595N of the Library of the University of Bologna), which reproduces Scipione's rule, which had been obtained from him by Pompeo Bolognetti, lecturer ad *praxim mathematicae* at Bologna in the years 1554-1568. Basing his conclusion on another text by Cardano and on a manuscript of the *Algebra* of Rafael Bombelli (MS B. 1569 of the Library of the Archiginnasio of Bologna, assignable to about 1550), Bortolotti concludes, with plausibility, that Scipione did indeed solve both the equations $x^3 + px = q$, and $x^3 = px + q$.

How Scipione arrived at the solution of cubic equations is not known. But there is no lack of attempts at reconstructing his method. For example, in his examination of the *Liber abbaci* of Leonardo Fibonacci and of the *Algebra* of Bombelli, Giovanni Vacca seemed to be able to reproduce, in the following simple procedure, the one used by Scipione: If the sum of square roots is expressed as

it can be seen, by raising to the square, that this satisfies the second-degree equation (lacking the term in x)

Analogously, if the sum of cube roots is expressed as then it can be seen, raising to the cube, that this satisfies the third-degree equation (lacking the term in X^2)

Therefore, equation (4) is solved by means of (3). If one writes

or

the cubic equation (4) and the formula which solves it (3) assume the accustomed form:

This latter is called Cardano's formula, but incorrectly because Cardano does not deserve credit for having discovered credit for having discovered it but only for published it for the first time.

Another of Scipione's contributions to algebra concers fractions having irrationsl denominators. The problem of rationalizing the denominator of such a fraction, when there are square roots intervening, goes back to Euclid. In the sixteenth century, k the same problem appears with roots of greater index. And here one can single out the case of fractions of the type

which Scipione was the first to deal with, as can be seen by the manuscript, Bombelli calls Scipione "a mauuniquely gifted in this art."

Finally, it should be noted that Scipione also applied himself to the geometry of the compass with a fixed opening, although this theory was ancient, the first examples going back to Abu'l-Wafa'(tenth century). In the first half of the sixteenth century, this question arose again, particularly because of Tartaglia, Cardano, and Ferrari. And it is because of the testimony of the last-named (Ferrari to Trataglia, *Quinto cartello*, p. 25) that we can state that Scipione also took up this problem, but we know nothing about his researches and his contributions.

BIBLIOGRAPHY

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II. Secondary Literature. See C. Malagola, *Della vita e delle opere di Antonio Urceo detto Codro* (Bologana, 1878), pp. 352-355, and app. XXVII, pp. 574-577, which contains "Documenti intorno a Scipione dal Ferro"; L. Frati, "Scipione dal Ferro," in *Bollettino di bibligrafia e storia della scienze matematiche*, **12** (1910), 1-5; and in *Studi e memorie per la storia dell'Università di Bologna*, **2** (1911), 193-205; E. Borolotti, "I Conntributi del Tartaglia, del Cardano, del Ferrari, e della scuola matematica bolognese alla teoria algebrica delle equazioni cubiche," in *Studi e memorie per la storia dell'Università di Bologna*, **10** (1929), 55-108, thence in the aforementioned volume of *Studi e ricerche;* and G. Vacca, "Sul commento di Leonardo Pisano al Libro X degli Elementi di Euclide e sulla risoluzione delle equazioni cubiche," in *Bollettino dell'Unione mathematica italiana*, **9** (1930), 59-63.

On Annibale dalla Nave, see A. Favaro, note in Eneström, *Bibliotheca mathematica*, 3rd ser., **2** (1901), 354.

On A. M. Fiore, see A. Masotti, note in *Atti* of the meeting in honor of Tartaglia, held at the Atheneum of Brescia in 1959, p. 42.

Ferro's role in the solution of cubic equations, is discussed in all histories of mathematics. See, for example, M. Cantor, *Vorlesungen über Geschichte der Mathematik;* J. Tropfke, *Geschichte der Elementar-Mathematik;* and D. E. Smith, *History of Mathematics, passim*.

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