Manuscrits de Evariste Galois. Publiés par JULES TANNERY. Paris, Gauthier-Villars, 1908. 67 pp.

THE articles published by Galois related to periodic continued fractions, the algebraic solution of equations (summary of results), and the introduction of quantities (now known as Galois imaginaries) determined as the roots of irreducible congruences. These brief articles appeared during the years 1828–1830 in the *Annales de Mathématiques* de M. Gergonne, and the *Bulletin des Sciences mathématiques* de M. Férussac. They have been reprinted as pages 1–23 of Œuvres mathématiques d'Evariste Galois, Paris, 1897. Pages 25–61 of the latter book give a reproduction of certain posthumous papers by Galois, which first appeared in Liouville's *Journal de Mathématiques*, volume 11 (1846), pages 408–444, fourteen years after the tragic death of the author. These posthumous papers are the celebrated letter to Auguste Chevalier, his fundamental memoir on the conditions for the solution of algebraic equations by radicals, and an incomplete manuscript on solvable primitive equations.

Chevalier prepared for publication the manuscripts entrusted to him by Galois and placed them in the hands of Liouville. The latter published the three papers just mentioned, promising in a footnote to add later some other fragments extracted from the papers of Galois, which, although without great importance, could be read with interest by geometers. However, this additional manuscript by Galois is now published, for the first time, by Tannery, who gives in a most faithful manner a minute account of all the Galois manuscripts, points out as far as possible the few annotations by Chevalier, and indicates by detailed references the occasional divergence between the original manuscript by Galois, the copy by Chevalier, the text by Liouville, and that of the Œuvres. On page 15, line 7, the correct reading 1, 2, 3 should replace 1, 3, 3, and not 1, 1, 3.

In contrast to the statement in Picard's Introduction to the Œuvres, "les deux Mémoires qu'il présenta à l'Académie des Sciences ayant été perdus," Tannery has now made it clear, on pages 5 and 6, that the manuscript presented to the Academy by Galois was not lost, but is precisely the one which passed into the hands of Chevalier, thence to Liouville, and has finally been given to the Academy of Sciences by Liouville's daughter. What was rejected in 1831 has now been received with honor! The manuscript bears the names Lacroix and Poisson of the members of the commission which passed upon this work of Galois on the solution of equations by radicals, now universally admitted to be one of the greatest triumphs of the human intellect. The verdict of the commission, however, delivered by Poisson in large handwriting, was simply "vu." The manuscript shows Galois's comment: "Oh! chérubins." There also appears in Liouville's writing "Rapport du 4 juillet 1831"; but he refrained from publishing the work until 1846 and then with all references to its earlier presentation to the Academy carefully deleted, though not on the first set of proofs still preserved. Liouville was the most conscientious of editors and there were details not clear to him in the manuscript of Galois; in fact, Liouville made various additions, afterwards suppressed, in an attempt to bring the manuscript into conformity with his precept "of being transcendentally clear." All honor to Liouville for recognizing the fundamental character of Galois's work and for preserving it to the profit of all ages.

The text of the manuscripts of Galois not previously published occupy over forty pages, including some work while still in school, and several introductions to memoirs merely planned, or else begun but left unfinished. The majority of the manuscripts are fragmentary notes bearing on the solution of equations by radicals. The second sentence on page 22 will be of interest. "Si maintenant vous me donnez une équation que vous aurez choisie à votre gré et que vous desiriez connaître si elle est ou non soluble par radicaux, je n'aurai rien à y faire que de vous indiquer le moyen de répondre à votre question, sans vouloir charger ni moi ni personne de le faire. En un mot les calculs sont impracticables." In defense of his method, however, he indicates that in practice one knows in advance properties of a proposed equation which will aid in applying his method. The same point may be raised in the application of Lie's theory. One does not make headway with equations, whether algebraic or differential, if selected at random or stripped of the information accompanying their origin.

M. Tannery has executed admirably the task he laid before himself. He has given to the world an impartial historical work of great interest, a necessary companion to the Galois text already available.

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