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(*b*. Leiden, Netherlands, *ca*. 1615; *d*. Leiden, 29 May 1660)

mathematics.

Schooten's father, Frans van Schooten the Elder, succeeded Ludolph van Ceulen at the engineering school in Leiden. The younger Schooten enrolled at the University of Leiden in 1631 and was carefully trained in the tradition of the Dutch school of algebra. In early youth he studied Michael Stifel's edition of Christoph Rudolff's German *Coss*. He was also acquainted with the Dutch and French editions of the works of Simon Stevin, with van Ceulen's *Arithmetische en geometrische Foundamenten*, and with Albert Girard's *Invention nonvelle en l'algèbre*. Schooten studied Girard's edition of the mathematical works of Samuel Marolois and his edition of Stevin's *Arithmétique*. He was of course familiar with Commandino's editions of Archimedes, Apollonius, and Pappus, and with Cavalieri's geomety of indivisiables.

It was probably through his teacher, the Arabist and mathematician Jakob Gool, that Schooten met Descartes, who had just come to Leiden from Utrecht to supervise the printing of the *Discours de la méthode* (1637). Schooten saw the proofs of the *Géométrie* (the third supplement to the *Discours*) by the summer of 1637 at the latest. He recognized the utility of the new notation, but he had difficulty in mastering the contents of the work. He therefore undertook a more intensive study of literature on the subject and sought to discuss the work with colleagues.

Armed with letters of introduction from Descartes, Schooten went to Paris. Although he was a convinced Arminian, he received an extremely cordial welcome from the Minimite friar Marin Mersenne and his circle. In Paris, Schooten was able to read manuscripts of Viète and Fermat; and, on a commission from the Leiden printing firm of Elzevier, he gathered all the printed works of Viète that he could find. He went next to England, where he met the leading algebraists of the day, and finally to Ireland.

Schooten returned home in 1643 and served as his father's lecture assistant, introducing a number of young people—including Jan de Witt—to mathematics. He also prepared a collected edition of the mathematical writings of Viète (1646). Although Schooten generally followed the original texts closely, he did change the notation in several places to simplify the mathematical statements and to make the material more accessible, for Viète's idiosyncratic presentation and the large number of Greek technical terms rendered the originals quite difficult to read. Unfortunately, because he misunderstood a remark that Viète made concerning the unsuccessful edition of his *Canon mathematicus* (1579), Schooten omitted this work and the interesting explanatory remarks that accompanied it from his edition. Schooten had also brought back copies of Fermat's papers, but he was unable to convince Elzevier to publish them, especially since Descartes had expressed an unfavorable opinion of Fermat's work.

In 1645 Christiaan Huygens and his elder brother Constantijn began to study law at Leiden. They attended Schooten's general introductory course (published by Erasmus Bartholin in 1651), and in advanced private instruction became acquainted with many interesting questions in mathematics. A close friendship developed between Schooten and Chtistiaan Huygens, as their voluminous correspondence attests. The letters reveal how quickly Huygens outgrew the solicitous guidance of his teacher to become the leading mathematician and physicist of his time.

Schooten's first independent work was a study of the Kinematic generation of conic sections (1646). In an appendix he treated the reduction of higher-order binomial irrationals to the form in cases where this is possible. using a development of a procedure of Stifel's An interesting problem that Schooten considered was how to construct a cyclic quadrilateral of given sides, one of which is to be the diameter-a problem that Newton later treated in the lectures on *Arithmetica universalis* (*Mathematical Papers*, V, 162–181).

After the death of his father in 1645, Schooten took over his academic duties. He also worked on a Latin translation of Descartes's *Géométrie*. Although Descartes was not completely satisied with Schooten's version (1649), it found a broad and receptive audience by virtue of its more carefully executed figures and its full commentary. It was from Schooten's edition of the *Géométrie* that contemporary mathematicians lacking proficiency in French first learned Cartesian mathematics. In this mathematics they encountered a systematic presentation of the material, not the customary, more classificatory approach that essentially listed single propositions, for the most part in unconnected parallel. further, in the Cartesian scheme the central position was occupied by algebra, whoch Descartes considered to be the only "precise form of mathematics."

The great success of Schooten's edition led him to prepare a second, much enlarged one in two volumes (1659–1661). which became the standard mathematical work of the period. A third edition appeared in 1683, and an appendix to the fourth edition (1695) contained interesting remarks by Jakob Bernoulli. In the second edition Schooten not only greatly expanded his commentary, but also added new material including an example of Fermat's extreme value and tangent method (with a reference to Hérigone's *Cursus mathmaticus* [*supplementum*, 1642]) and a peculiar procedure for determining the center of gravity of parabolic segments. Since Fermat was not mentioned in the latter connection. it is likely that Schooten came upon the procedure independently, for he usually cited his sources very conscientiously.

In the first edition (1649) Schooten inserted Debeaune's rather insignificant *Notae breves* to the *Géomérie*. The commentary of the second edition contained valuable contributions by Huygens dealing with the interesections of a parabola with a circle and certain corcollaries, as well as on an improved method of constructing tangents to the conchoid. Schooten also included longer contributions by his students: Jan Hudde's studies on equations and the rule of extreme values and Hendrik van Heuraet's rectfication method.

Volume 11 of the second edition of the *Geometria* (1661) commences with a reprinting of Schooten's introductory lectures. this material is followed by Debeaune's work on the limits of roots of equations and then by de Witt's excellent tract on conic sections. The volume concludes with a paper by Schooten's younger half brother pieter on the algebraic discussion of Descarte's data. This edition shows the great effort Schooten devoted to the training of his students and to the dissemination of their findings. This effort can be seen even more clearly in his wide-ranging correspondence, most of which is reprinted in Huygens' *Oeuvers complétes*. (Unfortunately, not all of Schooten's correspondence has been located.)

Schooten made an original contribution to mathematics with his *Exercitationes mathematicae* (1657). Book I contains elementary arithmetic and geometry problems similar to those found in van Ceulen's collection. Book II is devoted to constructions using straight lines only and Book III to the reconstruction of Apllonius' *Plane Loci* on the basis of hints given by Pappus. Book IV is a revised version of Schooten's treatment of the kinematic generation of conic sections, and book V offers a collection of interesting individual problems. Worth nothing, in particular, is the restatement opf Hudde's method for the step-by-step building-up of equations for angular section and the determination of the girth of the folium of Descares: $x^3 + y^3 = 3\,axy$. Also noteworthy is the determination of Heronian triangles of equal perimeter and equal area (Roberval's problem) according to Descartes's method (1633). As an appendix Schooten printed Huygens' *De ratiociniis in aleae ludo*, which was extremely important in the development of the theory of probability.

Schooten possessed an excellent knowledge of the mathematics of both his own time and earlier periods. Besides being an extraordinarily industrious and conscientious scholar, a skillful commentator,and an inspiring teacher, he was a man of rare unselfishness. He recognized his own limitations and did not seek to overstep them. Facinated by the personality and ideas of Descartes, he worked hard to popularize the new mathematics; his highly successful efforts assured its triumph.

BIBLIOGRAPHY

I. Original Works. Schooten's writings include his ed. of Viete's *Opera mathematica* (Leiden, 1646); *Deorganica conicarum sectionum in plano descriptione* (Leiden, 1946); *Geometria a Renato Descartes anno*1637 *gallice edita*, *nunc autem... in linguam latinam versa* (Leiden, 1646); 2nd ed., 2 vols., Amsterdam, 1659–1661; 3rd ed., 1683; 4th ed., Frankfurt, 1695); *Principia matheseos universalis*, E. Bartholin, ed. (Leiden, 1651), also included in the 2nd ed. of *Geometria*; *Exercitationum mathematicarum libri quinque* (Leiden, 1657) also in Flemish as *Mathematische Oeffeningen* (Amsterdam, 1660); and "Tractatus de concinnandis demonstrationibus geometricis ex calculo algebraico," Pieter van Schooten, ed., in the 2nd ed. of Geometria.

II. Secondary Literature. See J. E. Hofmann, "Frans van Schooten der Jüngere," in *Boethius*, II (Wiesbaden, 1962), with portraitl; and C. de Waard, "Schooten, Frans van," in *Nieuw Naderlandsch biographisch woordenboeck*, VII (1927), 1110–1114.

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