generalised KdV with $p \geq 3$, $r = 1$, there are only three conservation laws.

In the book *Linear and nonlinear waves,* by G.B. WHITHAM, New York, 1974, we find many recent results concerning the KORTEWEG-DE VRIES equation. In several necrologies of D.J. KORTEWEG published after his death in the age of 93 in 1941, the work of KORTEWEG, concerning the *Van der Waals surface,* concerning the *edition of Huygens' Oevres,* concerning *a simple connection between the perturbations of a plane periodic movement in three successive periods,* known as the theorem of KORTEWEG, was mentioned. But we do not find any reference to the paper with G. DE VRIES in the Phil. Mag. 1895. Nobody could predict in 1941, nearly 50 years after its publication in the doctors thesis of G. DE VRIES, that 80 years after its publication in 1894, it would become a hot topic in pure and applied mathematics.

DAVID BIERENS DE HAAN 1822—1895

H.J.M. Bos

INTRODUCTION

When, 99 years ago, the "Wiskundig Genootschap" celebrated its first centennial (since then the date of its foundation has been more accurately determined), David Bierens de Haan undoubtedly was its most important member. He was first secretary of the society, he was sole editor of its journal, the *Nieuw Archief voor Wiskunde,* and he was chairman of its "scientific committee" whose task, among other things, it was to set the prize questions. On the occasion of the centennial Bierens de Haan also published two old Dutch mathematical texts. These activities reflect the three main aspects of Bierens de Haan's professional life and work; he was a mathematician, a historian of mathematics and a public figure.

Obviously, the present collection should contain a biography of the man who held so prominent a position within the Dutch mathematical community. After dealing briefly with Bierens de Haan's early years, I shall divide this biographical note according to the above mentioned three aspects of his work.

EARLY YEARS

David Bierens de Haan was born in Amsterdam on the third of May 1822. His surname is a combination of the names of his father, the Amsterdam merchant Abraham Pieterszoon de Haan, and of his mother, Catharina Jacoba Bierens. The family was well off and enjoyed standing in the Dutch community; David and his brother Jan even had a coat of of arms, composed from the family coats of arms of their father and

mother.

The sons were educated by private tutors. In 1838 David's mother
died and his father retired from business. Three years later David
David started studies in law in Amsterdam (this was his father's wish),
but he soon chanted his subject and in 1842 he went to Leiden to study
mathematics. He terminated his studies in 1847 with a dissertation,
written under the supervision of G.J. Verdam, *on the Lemniscate of
Bernoulli*; the work gained him the doctorate "summa cum laude".

In 1848 Bierens de Haan moved to the country town of Deventer in
the Eastern part of the Netherlands at the river IJssel, to become a
eacher at the Gymnasium. Here he married in 1852 Johanna Cornelia
Jacoba IJssel de Schepper, a daughter of a well known Deventer family.
A year later he gave up his teacher's post to live on private means and
to devote most of his time to mathematical studies.

MATHEMATICIAN

The research which took so much of his time in the Deventer years
after 1853 had in fact started already in 1847; it concerned a survey
of definite integrals. As he explained in the preface (dated 1855) of
the *Tables d'intégrales définies* [1858] which formed the result of that
research, he had set himself four goals. First he wanted to collect and
list systematically all definite integrals which had been calculated
and which were spread in the mathematical literature of the last hundred
yeares (the subject can be considered to have its origin in Euler's
work). Secondly, he wanted to list together with the results, the methods
by which they were found. Thirdly, he hoped that his work would present
a historical survey of the subject, and finally he wanted to critically
check and if necessary correct the results he found in the literature.
It was an ambitious program and it needed precisely the perseverence
and the collector's mentality which Bierens de Haan had. He had to
carry out the program completely alone; a first call for communications
from other mathematicians in several journals did not sollicite any
response.

In each of his four goals Bierens de Haan encountered difficul-
ties. Collecting the results and thereby giving an historical overview

was impeded because not all literature was available in the Netherlands;
he mentions in particular that the Anglo-Saxon literature was inaccess-
ible to him. As to checking the results, there just was not time enough
to do it completely, and errors in transcription and typography proved
to be unavoidable.

But the most serious difficulties were connected with the second
goal, the survey of the methods. It proved impossible, for reasons of
space, to explain the methods in the tables. Still it was essential
that these methods should be mentioned because the value of the result
depended on the value of the methods, and Bierens de Haan was aware
that several of the then current methods were not above suspicion. In
his preface he explained this difficulty, his personal position in that
respect and the way he solved the difficulty. I quote this explanation
in full. It is revealing for the state of Analysis in the middle of
the nineteenth century, a period in which a move toward rigorous methods
had started but had not yet permeated all subjects within Analysis.

> "...une autre [difficulté] était d'une importance bien plus grande
> pour la rédaction de ces Tables. Ce n'est pas seulement pourtant
> contre les anciennes méthodes, que se sont élevées des objections
> dont j'ai parlé précédemment, mais plusieurs des méthodes nouvelles
> ou récemment appliquées ont subi le même sort. Et un mot, telle
> méthode employée, et par suite admise par tel Analyste, est rejetée
> comme fausse par un autre: donc les résultats obtenus par l'un ne
> sont pas admis par celui d'une opinion contraire. Fallait-il que je
> me fusse posé en juge? Je me suis souvent fait cette question: mais
> je n'osais le faire, je ne croyais pas les fondemens de cette partie
> de l'Analyse toujours basés sur des principes d'une telle stabilité,
> que l'on aurait le drot absolu de juger sans merci les pensées, les
> recherches d'un autre. C'est pourquoi j'ai aussi admis dans les
> Tables les résultats obtenus par des méthodes, que pour moi-même
> je ne saurais regarder comme valides. Je m'y suis résolu d'autant
> plus volontiers que l'annexion de noms des auteurs, qui ont déduit
> ces résultats au moins douteux, donne pour ainsi dire des poids,
> qui en indiquent et en mesurent la certitude et la vérité."
> [1858, p.VI].

So he had solved the problem of the reliability of the results by
adding bibliographical references to the sources where the calculations
could be found.

The words above were written in 1855, when Bierens de Haan had
collected most of the integrals in the tables which appeared three years
later. It is an impressive work, listing, in an ordered way, on 572

pages, values of definite integrals. Bierens de Haan devoted the three
years before its publication to a verification of the collected results
and this induced him to change the direction of his work more toward
the theoretical background of his subject. So when the tables appeared
in 1858 he was already working at his theory of definite integrals,
which he published in his *Exposé de la théorie, des propriétés, des
formules de transition et des méthodes d'evaluation des integrales
définies* [1862].

In this work Bierens de Haan was no longer unwilling to judge the
methods of others. He explained in his preface that the work for the
tables had convinced him of the necessity of a well founded theory and
that the problems of acceptability of the methods concern in particular
the various limit processes that are involved. The second edition
[1867] of the tables needed no longer the device of bibliographical
references to indicate the reliability of the methods; most of these
references were replaced by references to the *Exposé*. Also those results
which by the new theory were easy corrolaries of one central result,
were left out, and the space gained was used to incorporate many new
integrals calculated by Bierens de Haan himself.

The tables and the *Exposé* were well received in the international
mathematical community. There were translations and re-editions. The
Enzyklopädie article (BRUNEL [Enc.]) on definite integrals lists the
Exposé as the first of four textbooks on the subject and calls the
tables a "valuable collection", remarking however that it should not
be completely relied upon because of its many errors of typography or
transcription. The Swedish mathematician C.F. Lindmann has later
devoted much time and energy to correcting and supplementing the
tables.

The work earned Bierens de Haan general recognition as a mathe-
matical scientist. In 1856 he was chosen as a member of the Royal Dutch
Academy of Sciences; the Imperial Academy in Kazan made him a foreign
member in 1859; the "Académie Impériale des Sciences, Inscriptions et
Belles Lettres" of Toulouse honoured him with a gold medal in 1860;
a year later he became a member of the British Association for the
Advancement of Science. Finally the recognition of his mathematical

work resulted in a change of profession and domicile: in 1863 Bierens
de Haan was appointed as professor extraordinary at the Leiden univer-
sity. He was to assist Verdam, who could not fulfill all his duties
because of ill health. When Verdam died in 1867 Bierens de Haan suc-
ceeded him as ordinary professor.

His inaugural address in 1863 was on the "power of the so-called
inexistable in mathematics". It is a well presented survey of those
innovations in mathematics which had aroused the question of existence
of the newly introduced mathematical entities. Bierens de Haan dis-
cussed negative numbers, irrational numbers, complex numbers, Hamil-
tonian quaternions, infinitely small quantities, derivatives of frac-
tional order and other such subjects. The lecture is clear and appropri-
ate for the occasion where most of the listeners were not professional
mathematicians. But, very characteristically, the printed version of
the lecture [1863] contains extensive notes which in fact are complete
bibliographies of the subjects treated, and thus the publication forms
a valuable source for the historian who wans to study, for instance,
the early theory of complex numbers or the foundations of analysis in
the first half of the nineteenth century.

HISTORIAN OF MATHEMATICS

The collector's style which is apparent in Bierens de Haan's
mathematical activities is even more evident in his work on the his-
tory and historical bibliography of mathematics to which he devoted
most of his time since the early 1870s. This does not mean that this
interest arose only then; in fact his approach to the definite integrals
was already strongly historical-bibliographical. He was a lover of books
- he collected a large and valuable library which he bequeathed to the
Leiden University Library. Part of his library was a special collection
of logarithm tables. The interest in these tables resulted in two
publications, in 1862 and in 1875, of bibliographical lists of loga-
rithm tables. Of similar nature but wider scope was the Bierens de
Haan's *Bibliographie Néerlandaise* [1881]. This work lists mathematical
works of authors born between 1500 and 1800. It is still a valuable

and much used source, so much so that the indication "Bierens de Haan"
often occurs without further explanation in catalogues of antiquariats.
The *Bibliographie* was first published in successive issues of the
*Bullettino di bibliografia e di Storia delle sciene matematiche e
fisiche*; a separate edition in bookform appeared in 1883. By then
Bierens de Haan had published several other articles, in the *Bullettino*
(whose editor, the Prince Boncompagni, thought highly of his work as
a historian) and elsewhere, on various 16th and 17th century Dutch
mathematicians, on almanacs, on mathematical polemical pamphlets etc.
In 1874 he started a regular publication of such articles in the
Verslagen en Mededelingen van de Koninklijke Akademie van Wetenschappen.
He called the series "Bouwstoffen voor de Geschiedenis der Wis- en
Natuurkundige Wetenschappen in de Nederlanden" (Building materials for
the history of the mathematical and physical sciences in the Nether-
land) [1874 etc.]. Finally, the series contained 33 articles; the last
one appeared in 1893. A number of the articles was collected in private-
ly published books.

In 1884 Bierens de Haan edited two hitherto unpublished treatises
of Simon Stevin, two mathematical tracts by Spinoza, and an algebraical
treatise of Albert Girard.

The "Bouwstoffen" and the other bibliographical and historical
articles of Bierens de Haan contain useful material for specialists
in the history of Dutch mathematics, but because of their specialist
nature their inpact has not been very great. Much more important for
the history of mathematics, and of science in general, was the work
which he undertook in 1880 and to which till his death he devoted
most of his time. This was the edition of the *Oeuvres Complètes* of
Christiaan Huygens. In 1880 the plans for this edition arose; the
Royal Academy appointed Bierens de Haan as chairman of a committee to
study the possibilities and the "Hollandsche Maatschappij van Weten-
schappen" agreed to back the undertaking financially. It was decided
that Huygens' correspondence would be edited first. The preparatory
work was enormous, but in 1888 the first volume appeared and Bierens
de Haan saw 5 further volumes through the press. The edition ultimately
comprised 22 volumes and the last was published in 1955. It is generally
considered to be the best scholarly edition of the works of a scientist,
because of its extensive philological apparatus of footnotes, indices,
explanatory introductions and cross references. That the edition could
gain such a distinction within the source literature of the history
of science is primarily due to Bierens de Haan, who set the standards
for the editorial policy at the outset of the undertaking.

PUBLIC FIGURE

With his interest for bibliography and history, and with his
collector's style in mathematics, Bierens de Haan was far from a
solitary working closet scholar. On the contrary, he was very much
a public figure. He had an active interest in social and political work
and in the last 25 years of his life Bierens de Haan was the most im-
portant representative of the mathematical community in the Netherlands.

In 1858 he was elected as a town councillor of Deventer. His
interest in public affairs especially concerned education. In 1857 he
became inspector of primary education in the district around Deventer.
In the 1860's he actively participated (by writing articles and pamphlets)
in the debates on the reform of the Dutch secondary school system. He
also reviewed many mathematics textbooks and he edited reprints and
translations of textbooks, for instance a geometry textbook of Lacroix.
In Leiden he was a meber of the local school committee. Obviously,
higher education had his interest too, he was rector of the Leiden
university in 1872/3 and in that function he visited the München
university on the occasion of its fourth centennial. He wrote a lengthy
report on that visit which was published in the periodical *Vaderlandsche
Letteroefeningen*.

Bierens de Haan put his abilities in public and organisational
affairs also in the service of the Dutch mathematical community. He
was a meber of the "Wiskundig Genootschap" since 1841; in 1861 he be-
came a member of its scientific committee, since 1875 he was chairman
of that committee. In the same year he became first secretary of the
"Wiskundig Genootschap", a post which included the editorship of the
then founded journal of the Society, the *Nieuw Archief voor Wiskunde*.

Till his death, Bierens de Haan was editor of that journal.

CONCLUSION

In the introduction I spoke about the three aspects of Bierens de Haan's professional life and work, and I have discussed these in more detail above. But the picture emerging from that discussion is not complete, the more personal aspects are missing. Unfortunately, I have not been able to find much about Bierens de Haan's personal life. His youngest son, J.C.J. Bierens de Haan, has talked with D.J.E. Schrek, the writer of a short biography [1955]. Schrek tells us that "Bierens de Haan's character was earnest and well balanced; he was stoic and self-collected in every circumstance. Gentle and of a placid mood he was never acrimonious towards adversaries and he hated slandering. His way of life was regular and he was ...-devate in everything" ([1955], p.33). He liked travelling, walking and reading. He disliked controversies. He was a member of the Mennonite church, actively interested in theological affairs but averse of theological polemics.

The family lived in a large house at Leidens Breestraat. There were nine children. The early death of four of these in 1872 brought great grief in the house. Bierens de Haan himself suffered a grave attack of typhus in that year. The illness caused a heart condition which after 1890 gradually grew worse and eventually caused his death. The last years of his life were quiet. After his retirement in 1892, he got a room for himself in the Leiden University Library. There he worked daily, mostly at the Huygens edition. He died on the twelfth of August 1895.

Note

The most important sources on Bierens de Haan's life and work are KLUYVER e.a. [1896], SCHREK [1955] and DE WAARD [1927].
In the bibliography below I have cited only the most important works of Bierens de Haan; for details on the other works by Bierens de Haan to which I refer in the text, see KORTEWEG [1896].

BIBLIOGRAPHY

BIERENS DE HAAN, D.

[1858]   *Tables d'intégrales définies*, Verh. Kon. Ak. Wet. Afd. Natk. 4 (1858). pp. 1-572.

[1862]   *Exposé de la théorie, des propriétés, des formules de transformation et des méthodes d'évaluation des integrales définies*, Verh. Kon. Ak. Wet. Afd. Nat. 8 (1862), pp. 1-702.

[1863]   *Over de magt van het zoogenaamd onbestaanbare in de wiskunde* (inaugural adress, Leiden), Leiden 1863.

[1867]   *Nouvelles tables d'intégrales définies*, Leiden 1867.

[1874 etc.] *Bouwstoffen voor de geschiedenis der wis- en natuurkundige wetenschappen in de Nederlanden* (series of articles in Versl. Nederl. Kon. Ak. Wet., 2e ser., 8 (1874) and later issues).

[1881]   *Bibliographie Néerlandaise historico-scientifique des ouvrages importants dont les auteurs sont nés aux 16e, 17e et 18e siècles, sur les sciences mathématiques et physiques avec leurs applications*, a series of articles in Bullettino bibl. stor. sci mat. fis., 14 (1881), 16 (1883). Separately published Rome 1883.

BRUNEL, G. [Enc.] *Bestimmte Integrale*, Enzyklopädie der Mathematischen Wissenschaften (Leipzig 1898 sqq), Vol. II.I.1, pp. 135-188.

KLUYVER, J.C., D.J. KORTEWEG and P.H. SCHOUTE [1896], *David Bierens de Haan*, Nw. Arch. Wisk. (ser. 2), 2 (1896), pp. I-XI.

KORTEWEG, D.J. [1896], *Lijst der Geschriften van dr. D. Bierens de Haan*, Nw. Arch. Wis. (ser. 2), 2 (1896), pp. XIII-XXVIII.

D.J.E. SCHREK [1955], *David Bierens de Haan*, Scripta Math. 21 (1955), pp. 31-41.

WAARD, C. DE [1927], *Haan, David Bierens de*, Nieuw Nederlands Biografisch Woordenboek 7 (1927), col. 512-513.