

Travelling Mathematics - The Fate of Diophantos' Arithmetic

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Preface

Anyone studying the work of Diophantos of Alexandria is immediately confronted with three questions: ‘Who was Diophantos?’, ‘How large was his algebraic knowledge?’ and ‘To what extent are Diophantos’ writings unique within the classical mathematical corpus?’

Unfortunately, none of these questions can be answered satisfactorily. Not only is there scant biographical evidence to go on, but the Diophantine corpus also remains rather elusive. Depending on one’s position, it lends itself to either minimization or *hineininterpretierung*. Nonetheless, Diophantos’ writings have, alongside the work of Heron, come to occupy a special position within the Greek mathematical corpus. Or rather within the *known* ancient mathematical corpus. This qualification is not unimportant, particularly as nearly all of our knowledge of ancient mathematics has come to us via copies, implying that it is to an extent filtered by the choices and judgments of mediæval scribes.

Be that as it may, Diophantos’ *Arithmetika*, despite its relative isolation within the classical Greek corpus, represents a phase in the evolution from a syntactic to a symbolic algebra, which we may refer to as synoptic algebra. In the opening chapters, we shall therefore focus first on the development of algebra in Egypt and Babylon before attempting to formulate answers to the aforementioned questions. Subsequently, we shall consider how the *Arithmetika* influenced the work of Pierre de Fermat.

The classic English study in this field is still Sir Thomas Heath’s translation of Diophantos’ six Greek books. However, since the publication of this seminal work, many new facts have come to light, not in the least through the discovery of some Arabic manuscripts. It would therefore seem worthwhile to provide an updated account of our understanding of Diophantos and his writings.

The idea for this study came to me during my work on sixteenth-century Netherlandish algebra, more in particular the writings of Simon Stevin, who translated four of the six Greek Diophantos books into French. This first and foremost provided the inspiration for a new Dutch translation (the first, in fact, in over 250 years) of the Greek books of the *Arithmetika*. This Dutch version was produced by my wife, a classical scholar. In addition to the translation, however, we felt it necessary also to explain the mathematics. Our edition, published by Antwerp

University College Press (now Artesis University College Antwerp Press) in 2006, therefore has a special layout: the right-hand pages contain the translation, while the left-hand pages provide a mathematical elucidation in modern notation¹. This is preceded by an introduction, which –due to space restrictions– had to be shortened, leaving us with the feeling that Diophantos and the fate of his books merited a more extensive account. One thing led to another, and hence this monograph.

There are essentially three ways a contemporary author can render ancient mathematics. He can provide a full-length translation of the original text and leave the interpretation to the reader, or he can render the text in modern mathematical notation, or he can use a semi-symbolic notation that some argue can capture the flavour of the ancient text while also offering the conciseness of modern notation. The latter option, however, would leave the reader with such cumbersome formulae as: $\sqrt{\square\square}(\square a, \square b) = \square\square(a, b)$, which a contemporary mathematician would immediately translate as $\sqrt{a^2b^2} = ab$.

We feel that such a semi-symbolic notation fails on both counts: it is too far removed from the original flavour of the text as well as its mathematical content, and consequently there is a risk it will merely alienate the modern reader from the essence of Diophantos. We have therefore chosen instead to cite the original text where appropriate and to indicate which pitfalls may present themselves when reading it. However, as excessive citing would become tedious and distract the modern reader, we also rely on anachronistic mathematical formulae. We feel this approach offers closer insight into the thinking underlying the writings discussed here, while also doing full justice to their ancient authors' accomplishments. Although the contemporary reader must always bear in mind the Italian adage *traduttore traditore* – in respect of both the translation of the ancient text and its mathematical reformulation – we believe that the combination of text and formulae provides a good basis for a better understanding of *the Arithmetika* and related texts, as well as the issues that ancient mathematicians faced in noting down their work.

In the ten-or-so years it has taken to conclude this study, we have been supported by many people and institutions. Over this period, we have contracted debts of gratitude we can hardly contemplate ever being able to repay adequately. We were also fortunate enough to see our Dutch translation of Diophantos being awarded the Jan Gillis prize of the Royal Flemish Academy of Belgium for Science and the Arts, which provided the necessary funds for further research. We are also indebted to Artesis University College for their support through a scientific project grant and for their permission to use parts of our introduction to the Dutch Diophantos translation in this monograph. The present study would never have materialized either without the cooperation of various libraries, particularly the library of the Teacher Training College of the Artesis University College Antwerp, the Erfgoedbibliotheek Hendrik Conscience (Antwerp) and Museum Plantin More-

¹Heath's translation is in fact a compromise between a translation of the Greek text and a retranslation into mathematical symbolism, which has left us with neither a good edition, nor good mathematics. Nonetheless, it succeeds brilliantly in bringing across the Diophantine flavour.

tus (Antwerp). We are also grateful to Stephen Chrisomalis (Wayne State University) for his kind permission to reproduce the illustration of demotic figures. Special thanks are due to two colleagues for reading drafts of the manuscript and for making useful suggestions: Guido Vanden Berghe and, as always, Jean Paul van Bendegem. The long-standing cooperation with Paul Tytgat (Department of Industrial Sciences) once again proved invaluable: most of the drawings in this book are by his hand. Stephen Windross read and corrected the English draft.

Finally, I must thank my wife Nicole for her continuous support over the past twenty years. Her contribution was a genuine labour of love.

Ad Meskens, 2010