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Mathematics à la carte – Babylonian algebra. (Mathematik à la carte – Babylonische Algebra.) (German) Zbl 1537.01002

Berlin: Springer Spektrum (ISBN 978-3-662-66286-1/pbk; 978-3-662-66287-8/ebook). viii, 238 p. (2022).

In 2019–2020, the author and his pupils at the gymnasium of St. Gertrudis (Ellwangen, Germany) produced a German translation of *J. Høyrup*'s [Algebra in cuneiform. Introduction to an Old Babylonian geometrical technique. Berlin: Edition Open Access, Max Planck Institute for the History of Science (2017; Zbl 1392.01003)]. The translation was published in 2021 in the same series of the Max Planck Institute for the History of Science (Berlin) as the English original. The present book was inspired by this project. It partly covers the same ground as Høyrup's 'Algebra in cuneiform', but it is more strongly focussed on the so-called quadratic problems, which are explained in great detail and clarity. The book aims at an audience of teachers, students, and non-specialists with some basic knowledge of school mathematics. It consists of twelve chapters, which are arranged and structured in the manner of a textbook, each chapter concluding with a series of exercises.

Chapter 1 introduces some features of the Roman, Ancient Egyptian, and Mesopotamian number notations. Chapter 2 introduces the basic arithmetical operations in the framework of Mesopotamian sexagesimal place value notation, namely addition, subtraction, multiplication, and division. Chapter 3 presents a series of elementary properties and propositions of plane geometry, using a Euclidean framework, in order to prepare the reader for solving a number of geometrical problems, mainly inspired by Babylonian problem texts. Chapter 4 covers the topic of reciprocal numbers and their computation in sexagesimal place value notation in accordance with Babylonian algorithms. Chapter 5 deals with the method of false position, which is frequently attested in the Babylonian texts. Chapter 6 explains several ancient methods for computing and approximating square roots inspired by Babylonian, Greek, and Chinese sources. Chapter 7 explains the geometric method of quadratic completion, which is attested in Babylonian tablets for solving square problems. This method is a core element of Jens Høyrup's geometric reinterpretation of the Babylonian square problems. Chapter 8 deals with what is referred to as systems of quadratic equations, which are likewise interpreted geometrically in terms of the manipulation of squares and rectangles. After these preparations, the reader is fully equipped to study Chapters 9–11, which constitute the climax of the book. They deal with the Old Babylonian tablet BM 13901, a compendium of 23 square problems, that has played a central role in Jens Høyrup's investigations. Chapter 9 contains a German translation of the complete tablet derived from Jens Høyrup's English translation. The latter so-called conformal translation is much more literal than the one by Otto Neugebauer. This was a crucial step for revealing the geometric nature of the solution procedures which had been lost in the pioneering translations of Otto Neugebauer (1935–1937). Chapter 10 contains modern algebraic interpretations of the solution procedures in the style of Otto Neugebauer, and Chapter 11 contains geometric interpretations of the same problems based on the investigations by Jens Høyrup. Finally, Chapter 12 covers a selection of other Babylonian quadratic problem texts, of which the solution procedures are likewise interpreted or reconstructed following Jens Høyrup's geometric approach. The book concludes with an appendix (A) with photographs and handcopies of several elementary Babylonian mathematical tables, a second appendix (B) with solutions to selected exercises, and a bibliography.

The approach to the Babylonian sources that underlies the book is indebted to Jens Høyrup's innovative translations and interpretations, known mainly from his seminal monograph "Lengths, widths, surfaces" [New York, NY: Springer (2002; Zbl 0999.01001)]. However, the material provided in each chapter goes beyond a discussion of the Babylonian sources. The didactical qualities of the book and its author stand out clearly in the efforts that are made to provide the reader with basic mathematical arguments, diagrams, and formulas, partly derived from Euclidean and modern mathematics, and examples from other pre-modern cultures. All of this auxiliary material is intended to support the explanations or shed some interesting light on the Babylonian methods. In this regard the approach of the book can be said to be partly ahistorical, in spite of the close adherence to Jens Høyrup's translations, since it is not always clear if the auxiliary arguments and concepts that are provided in each chapter were known to the Babylonian mathematicians. However, this does not reduce the value of the book, which can be read as a lucid

and didactically sound introduction to Jens Høyrup's groundbreaking interpretations of the Babylonian square (quadratic) problems. The author is also to be praised for (re)introducing Babylonian mathematics into the modern school context and arguing persuasively for the educational and didactical value of approaching quadratic problems using Babylonian geometric methods.

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Reviewer: Mathieu Ossendrijver (Berlin)

MSC:

01-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to history and biography
01A17 History of Babylonian mathematics
97A30 History in mathematics education

Keywords:

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