Introduction

Why is there a need for a new sourcebook in Greek mathematics? After all, the major Greek authors—Euclid, Archimedes, Apollonius, Ptolemy, Diophantus, Pappus – all have well-regarded and easily available English editions or, in the case of Archimedes, an English edition in process. And passages from Greek mathematics are available in some of the more general sourcebooks in mathematics. For example, the 1987 *History of Mathematics: A Reader*, edited by John Fauvel and Jeremy Gray, compiles English translations of original sources pertaining to mathematics from the very beginnings of human history to the current era. A portion of the book is dedicated to Greek mathematics; original sources are included as well as passages from historians reflecting on the field and excerpts from various scholarly debates over relevant issues. However, most of the passages are quite brief, largely because Greek mathematics is but one of the cultures and time periods that feature in this compendium of historical mathematical sources.

More specifically is Ivor Thomas's *Greek Mathematical Works*, first published as two volumes in 1939/41 as part of the Loeb Classical Library. This classic sourcebook is dedicated entirely to Greek mathematics. The volumes contain excerpts from Greek mathematical sources with Greek text on the left-hand side and translations on the facing page. The passages are organized chronologically, and their translations generally derive from scholarly authorities at the time. Little mathematical explanation accompanies the passages, although there are various mathematical and historical footnotes where appropriate.

In recent decades, there has been extensive research on Greek mathematics that has considerably enlarged the scope of the topic. Namely, although most mathematicians regard "Greek mathematics" as the axiomatically based mathematics introduced to the world in the work of Euclid, Archimedes, Apollonius, and others in the first three centuries BCE, there is in fact much more mathematics that was studied and used in the eastern Mediterranean during the time it was under substantial Greek cultural influence, say, from 400 BCE to 600 CE, and in certain areas even longer.

To reflect this, in addition to well-known material from the classic Greek texts, this sourcebook also contains passages from lesser known authors, some of whose works are now hard to find, as well as material from newly uncovered texts and

passages that have been left out by past scholarship, which was often based on more narrow definitions of "mathematics." Indeed, the Thomas sourcebook was written to accompany Thomas Heath's classic *History of Greek Mathematics*, first published a century ago. More recent historical surveys, such as David Fowler's *Mathematics of Plato's Academy*, Serafina Cuomo's *Ancient Mathematics*, and Reviel Netz's *New History of Greek Mathematics*, for instance, have significantly expanded the scope and richness of the field. It is thus timely to provide an up-to-date sourcebook that reflects this increased breadth, scope, and diversity.

While the majority of passages are translations from works written in ancient Greek, we have also included passages from Greek works whose originals are no longer extant but whose translations into Arabic during the eighth and ninth centuries are still available. We have also included passages from adjacent cultures of inquiry in which there are commonalities in the mathematical material, including sources originally written in Latin, Demotic, and Babylonian cuneiform.

In general, the excerpts we have included are often longer than those found in other sourcebooks to enable readers to follow the mathematical arguments in detail and understand their context. Although it is not possible to include every prerequisite to every theorem presented, we have made an effort of give the reader all the mathematical tools necessary to understand the proofs. We have used a broad scope in defining mathematical practice, so activities such as astronomy, music, and optics find a place here. The excerpts are organized into chapters by topic, enabling the reader to see how different authors treated the same mathematical ideas. While these divisions are in part inspired by early groupings of the mathematical sciences, we acknowledge that this overall organization might not always reflect how the original authors viewed the contours of their discipline. We provide a preface to each excerpt, to put the mathematical ideas into context, as well as explanations to help readers understand the arguments and, sometimes, to put the arguments into modern mathematical notation.

In addition to prose texts, other forms of mathematical activity are included here. For example, some numerical tables provide direct evidence of Greek mathematicians carrying out hand computations and recording the resulting numerical values. Instrumentation, too, embodies mathematical principles, and to this end we include discussions on the Antikythera Mechanism, the mechanical astronomical device discovered in a the remains of a ship wreck, early in the twentieth century, that is based in part on mathematically derived cycles.

Among the other special features of this book are ancient commentaries on the classic works of Euclid, Archimedes, and Apollonius. In many cases, we have interspersed these commentaries in the main body of the work, so that readers can easily understand what the commentators were trying to accomplish. We have used a different typeface to distinguish the commentaries from the original sources, as explained in each chapter.

We have also included passages about numbers that are more philosophical than technical, which were part of the effort by the so-called neo-Pythagoreans to understand fully the nature of the concept of "number." Another group of excerpts, not included in previous sourcebooks, are sourced from papyri discovered in Egypt, written during the Greek period in either Greek or Demotic. These passages are

necessarily short, because only a few such papyri are extant, and many of them are fragmentary. Even though it is sometimes difficult to discern the author's intent, it does seem that mathematical ideas were being used and that these ideas are quite different from the theoretical geometry of the classic texts. Many of these papyri appear to be from teachers of mathematics compiling lists of problems to pass on much simpler ideas to students or practitioners. Although it is difficult to draw firm conclusions because of the paucity of textual material, it does seem that teachers in Egypt during the Greek period were using the same ideas as their predecessors in Seleucid Babylonia and that Roman surveyors, some years later, also used these ideas. Precisely how such ideas were passed on from era to era and from place to place remains very much in question.

In the process of compiling excerpts from such a wide variety of modern sources that have been produced according to individual translators' conventions, we have generally preserved the format in which they appear in their modern translations, rather than edit them to achieve consistency throughout the sourcebook. This is so that if the reader wishes to refer back to the original publication in which these translations appear and read more, they can consult the original relatively easily. One way that modern translations often differ is how they represent Greek lettered points. Some modern authors use the original Greek letters (e.g., A, B, Γ, Δ, . . .), others transliterate them (i.e., *A, B, G, D*, . . .), and yet others "translate" these to the modern English alphabet (i.e., *A, B, C, D*, . . .). We have not attempted to homogenize these Greek lettering practices. We have also modified some of the translations to eliminate modern symbolism, given that the Greek authors wrote in prose sentences. However, in certain cases of standard phrases, we do use symbols to shorten the reading. For example, we use sq(*AB*) to represent "the square on the line segment *AB*" and rect(*AB, BC*) to represent "the rectangle spanned by the line segments *AB*, *BC*."

Although we have given birth and death dates where known for most of the writers whose works we present, these dates are frequently very approximate. Birth and/or death dates are known precisely for very few Greek authors. In fact, for many we are not even sure of the century of their *floruit*.

We hope that students and teachers of mathematics and the history of mathematics alike will be inspired by the broad selection of sources testifying to a diverse range of mathematical activity developed and applied in the eastern Mediterranean some two millennia ago and will use this as a springboard to investigate areas that capture their interest.