THE ELEMENTS OF LOGARITHMS; WITH AN EXPLANATION OF THE THREE AND FOUR PLACE TABLES OF LOGARITHMIC AND TRIGONOMETRIC FUNCTIONS

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649403400

The Elements of Logarithms; With an Explanation of the Three and Four Place Tables of logarithmic and trigonometric functions by James Mills Peirce

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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Trieste

Hunter & Bowen.
Nov. 2d, 1873.

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BY

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BOSTON
PUBLISHED BY GINN BROTHERS
1873

CAMBRIDGE:
PRESS OF JOHN WILSON AND SON.

PREFACE.

THIS little book is meant chiefly for beginners; but I have also had in view the wants of more advanced students who are seeking to refresh and deepen their knowledge. The sections included in brackets are inserted for their benefit; and it is my purpose to add, in a future edition, chapters on the natural system, series, and the errors incident to simple interpolation, so as to make the book a complete manual of all that can be considered as belonging to the elements of the subject.

Logarithms ought not to be comprised, as they often are, in the midst of a treatise on algebra. For, in the first place, they are not algebraic functions; and, besides this, the student is unlikely to form an adequate comprehension of their purpose or to appreciate the importance of acquiring skill in the use of his tables, if he takes them up in the course of a study to which they have no application. If logarithms must needs be combined with any other branch of mathematics, their true alliance, on grounds both

theoretical and practical, is not with algebra, but with trigonometry. But it seems to me desirable that so important a subject should be studied by itself, and studied fully and thoroughly; and the aim of the teacher should be the double one of expounding the doctrine of logarithms in a concise, accurate, and clear form, and of inculcating and enforcing good practical principles in the use of tables. It has been my endeavor, accordingly, in writing these pages, not, of course, to convert the learner into an accomplished computer, but to set him on the right road towards becoming such if he pleases, and, at all events, to lead him to form the sound habits of work without which little beneficial discipline is derivable from this study.

I hope that teachers who are preparing pupils for Harvard College, where logarithms are now required for admission, will find that this volume furnishes them with a satisfactory text-book. The course I would recommend for such students comprises all that precedes the Appendix, except the bracketed portions. Those teachers who have not time to go over so much ground will find it possible to omit also §§ 7, 8, 13, 15, 17, 18, and 43, and perhaps some other sections. Those, on the other hand, who are able to exceed the course described above are advised to take up the table of Logarithms of Sums and Differences.

Only the rudiments of the theory of logarithms

are required at the examination, but candidates are expected to be thoroughly drilled in practical work. Applicants in Course II., however, should be well prepared on all the unbracketed parts of the book, including the Appendix. The use of the trigonometric tables is not required for admission in Course I.

I would further respectfully ask the attention of professors of mathematics in other colleges to the desirableness of putting into the hands of students tables of three or four places instead of the bulky volumes which even practical computers need for only the more delicate kinds of work, and especially instead of the inconvenient and poorly constructed tables often found bound up in the same covers with a work on trigonometry. This has been pointed out by several of the best authorities abroad, and is, no doubt, widely acknowledged here as well. I venture to hope, therefore, that the publication of this little treatise will induce a more general employment of the tables to which it is designed as a companion.

J. M. PEIRCE.

CAMBRIDGE, *October* 1878.

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THE

ELEMENTS OF LOGARITHMS.

CHAPTER I.

GENERAL PRINCIPLES.

§ 1. Logarithms are numbers that are substituted in computation for other numbers, to which they bear such a relation that the operations to be performed on the latter are represented by simpler operations performed on the former. The method of logarithms was first propounded in 1614, in a book entitled *Mirifici Logarithmorum Canonis Descriptio*, by JOHN NAPIER (latinized *Nepērus*), Baron of Merchiston in Scotland, who was born about 1550, and died in 1618, four years after the publication of his memorable invention. This method has contributed very powerfully to the modern advance of science, and especially of astronomy, by facilitating the laborious calculations without which that advance could not have been made. It is also constantly employed in surveying, navigation, and other branches of practical mathematics; and it may be used with much advantage in all multiplications and divisions of numbers of three or more figures.

Besides their usefulness in computation, logarithms fill an important place in the higher theoretical mathematics; but, in this book, we shall consider them almost wholly in their practical aspect.