Natural Sines to Every Second of Arc, and Eight Places of Decimals. By EMMA GIFFORD. Published by Mrs. Gifford, Oaklands, Chard, Somerset, 1914. vi + 543 pp. Price £ 1.

UNTIL the opening years of the twentieth century it seemed quite unnecessary to undertake the computation of tables of natural functions beyond what had long been in print. The recent development of various types of calculating machines, however, has destroyed the monopoly held by logarithms for the past three hundred years, and has restored to the natural function something of its early prominence, particularly in the work in astronomy. When Georg Joachim, surnamed Rheticus (b. 1514), computed his great table to every 10″ of arc and to ten figures, it was thought that nothing further could well be demanded, and the posthumous publication of these tables by Valentine Otho, under the title of Opus Palatinum (1596) was justly felt to mark a great epoch in mathematical progress. The invention of logarithms only a few years later, however, relegated the work of Rheticus to a position of relative insignificance, and there it would have remained had not the rapid progress of calculating machinery in recent years rescued it from this unhappy position.

In 1897 Jordan published his table of natural sines, which was a reprint of Rheticus to every 10″ of arc and to seven figures. This was the first important evidence of the return of the natural function to its former position, but it merely made accessible an important part of the Opus Palatinum, so that it represented nothing new in its line.

Mrs. Gifford started out to work de novo on a table of natural sines to every second of arc, not having access to the work of Rheticus when she began. By the expenditure of an amount of time and work which seemed out of all proportion to the results secured she computed two hundred and forty sines. She then secured a copy of the Opus Palatinum and proceeded to find the sines by interpolation, checking from the results she had already secured and from Callet's centesimal table in which are given a thousand sines to the quadrant, or one to every 324″ of arc. When in doubt as to the eighth decimal place she checked by the equation $\sin^2 x + \cos^2 x = 1$. The work of interpolation was performed by the aid of a Thomas calculating machine, using the figures given by

Rheticus for every 10″ of arc, and carrying these to ten decimal places as in the original table.

The arrangement of the table is not semiquadrantal, as in those in common use. This latter form does not lend itself easily to a large octavo page when the work is carried out to every second. Otherwise the arrangement is similar to that found in Chambers and other familiar tables. A convenient table of differences is given in the margin for each half of each page,—that is, for every 5′ of arc.

As to the accuracy of the work it is too early to speak. A set of tables containing a million and a half figures is sure to have errors, particularly as nine of the ten columns on a page represent new calculations. On the other hand Mrs. Gifford is a careful and experienced computer, she has had the aid of the best machinery and tables, and she has checked her work with care, so that it is probable that the number of misprints and errors in calculation has been reduced much below that found in the older type of tables.

Aside from the recent work of M. Andoyer, no such notable contribution to this kind of mathematical literature has been made for many years, and Mrs. Gifford is to be congratulated upon the completion of her labors in this important field. The tables should be in the library of every higher institution of learning, and in every astronomical and mathematical laboratory.

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Applied Mathematics. By H. E. COBB. Ginn and Company, 1911. vii + 274 pp.

WE meet many calls for "real problems" and "useful mathematics" but too often there is a failure to distinguish carefully between what is useful, what is real, and what is concrete. Carson* has ably drawn the distinction between these terms and forcefully argues that real mathematics is what we need. "The essence of reality is found in definite recognizable percepts or concepts, and is therefore a function of the individual and the time"; that is, reality depends upon the past experiences of the individual and not only upon the subject matter. It is doubtful whether the author of the book under review has kept this important distinction in mind, but the teacher may select such parts as represent reality for his particular students.

* Essays on Mathematical Education, Ginn and Co., p. 35.