ELEMENTS OF PLANE AND SPHERICAL TRIGONOMETRY, WITH THEIR APPLICATIONS TO MENSURATION, SURVEYING, AND NAVIGATION

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Elements of plane and spherical trigonometry, with their applications to mensuration, surveying, and navigation by Elias Loomis

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ELIAS LOOMIS

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Trieste

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MENSURATION, SURVEYING, AND NAVIGATION.

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PREFACE.

The following treatise constitutes the third volume of a course of Mathematics designed for colleges and high schools, and is prepared upon substantially the same model as the works on Algebra and Geometry. It does not profess to embody every thing which is known on the subject of Trigonometry, but it contains those principles which are most important on account of their applications, or their connection with other parts of a course of mathematical study. The aim has been to render every principle intelligible, not by the repetition of superfluous words, but by the use of precise and appropriate language. Whenever it could conveniently be done, the most important principles have been reduced to the form of theorems or rules, which are distinguished by the use of italic letters, and are designed to be committed to memory. The most important instruments used in Surveying are fully described, and are illustrated by drawings.

The computations are all made by the aid of natural numbers, or with logarithms to six places; and by means of the accompanying tables, such computations can be performed with great facility and precision This volume, having been used by several successive classes, has been subjected to the severest scrutiny, and the present edition embodies all the alterations which have been suggested by experience in the recitation room.

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TRIGONOMETRY.

BOOK I.

THE NATURE AND PROPERTIES OF LOGARITHMS.

ARTICLE 1. Logarithms are numbers designed to diminish the labor of Multiplication and Division, by substituting in their stead Addition and Subtraction. All numbers are regarded as powers of some one number, which is called the *base* of the system; and the exponent of that power of the base which is equal to a given number, is called the logarithm of that number.

The base of the common system of logarithms (called, from their inventor, Briggs' logarithms) is the number 10. Hence all numbers are to be regarded as powers of 10. Thus, since

$10^0=1$,	0	is the	logarithm of	1	in Briggs'	system;
$10^1=10$,	1	"	"	10	"	"
$10^2=100$,	2	"	"	100	"	"
$10^3=1000$,	3	"	"	1000	"	"
$10^4=10000$,	4	"	"	10,000	"	"
&c.,			&c.,		&c.;	

whence it appears that, in Briggs' system, the logarithm of every number between 1 and 10 is some number between 0 and 1, *i. e.*, is a proper fraction. The logarithm of every number between 10 and 100 is some number between 1 and 2, *i. e.*, is 1 plus a fraction. The logarithm of every number between 100 and 1000 is some number between 2 and 3, *i. e.*, is 2 plus a fraction, and so on.

(2.) The preceding principles may be extended to fractions by means of negative exponents. Thus, since

$10^{-1}=0.1$,	-1	is the	logarithm of	0.1	in Briggs'	system;
$10^{-2}=0.01$,	-2	"	"	0.01	"	"
$10^{-3}=0.001$,	-3	"	"	0.001	"	"
$10^{-4}=0.0001$	-4	"	"	0.0001	"	"
&c.,			&c.,		&c.	