NEW PLANE AND SPHERICAL TRIGONOMETRY; SIX PLACE LOGARITHMIC TABLES

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649657179

New Plane and Spherical Trigonometry; Six Place Logarithmic Tables by Webster Wells

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

WEBSTER WELLS

NEW PLANE AND SPHERICAL TRIGONOMETRY; SIX PLACE LOGARITHMIC TABLES

Trieste

NEW

PLANE AND SPHERICAL

TRIGONOMETRY

BY

WEBSTER WELLS, S.B.

PROFESSOR OF MATHEMATICS IN THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

D. C. HEATH AND COMPANY

BOSTON NEW YORK CHICAGO ATLANTA

DALLAS SAN FRANCISCO LONDON

KF3354

COPYRIGHT, 1896,
BY WEBSTER WELLS.
3 c 1

Printed in U. S. A.

PREFACE.

In revising his Plane and Spherical Trigonometry, the author has effected many important improvements. The attention of teachers is specially invited to the following features of the new work:

1. The proofs of the functions of 0°, 90°, 180°, and 270°; §§ 22 to 25.

2. The proofs of the functions of 120°, 135°, etc.; § 27.

3. The method of finding the values of the remaining functions of an angle when the value of any one is given; § 28.

4. The proofs of the functions of $(-A)$, and $(90° + A)$, in terms of those of A; §§ 29, 30.

5. The method of solution in the examples of §§ 34 and 35.

6. The general demonstration of the formulæ for $\sin(x+y)$ and $\cos(x+y)$; § 42.

7. The discussion of the line values of the functions, and their application in tracing the changes in the six principal functions of an angle as the angle increases from 0° to 360°; §§ 60, 61.

8. The discussion of trigonometric equations in § 62.

9. The solution of right triangles by Natural Functions; see Ex. 1, page 54.

10. The discussion of the ambiguous case in the solution of oblique triangles; §§ 117 to 120.

11. The proof of the formulæ for the values of x in the cubic equation $x^3 - ax - b = 0$; § 126.

12. The *geometrical* proof of the important theorems of § 133.

13. The demonstration of the formulæ for right spherical triangles *before* those for oblique spherical triangles; see Chapters XI. and XII.

14. The reduction of the number of cases in the complete demonstration of the fundamental theorems for spherical right triangles, to three, by application of the theorems of § 133; see § 136.

15. The solution of Quadrantal and Isosceles Spherical triangles; §§ 149, 150.

16. The discussion of the ambiguous cases in the solution of oblique spherical triangles; §§ 165, 166; especially the rules given on pages 108 and 111 for determining the number of solutions.

At the end of Chapter XII. will be found a collection of formulæ in form for convenient reference.

The revised work contains a much greater number of examples than the old; they have been selected with great care, and are with few exceptions new.

The results have been worked out by aid of the author's new Six Place Logarithmic Tables, which contain also a Table of Natural Functions, and an Auxiliary Table for Small Angles. The Trigonometry can be obtained either with or without the Tables.

WEBSTER WELLS.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1896.

CONTENTS.

PLANE TRIGONOMETRY.

		Page
I.	Trigonometric Functions of Acute Angles	1
II.	Trigonometric Functions of Angles in General	6
III.	General Formulæ	19
IV.	Miscellaneous Theorems	29
V.	Logarithms	41
	Properties of Logarithms	43
	Applications	47
	Exponential Equations	51
VI.	Solution of Right Triangles	54
	Formulæ for the Area of a Right Triangle	60
VII.	General Properties of Triangles	62
	Formulæ for the Area of an Oblique Triangle	65
VIII.	Solution of Oblique Triangles	67
	Area of an Oblique Triangle	74
IX.	Cubic Equations	77

SPHERICAL TRIGONOMETRY.

X.	Geometrical Principles	80
XI.	Right Spherical Triangles	83
	Solution of Right Spherical Triangles	88
XII.	Oblique Spherical Triangles	96
	General Properties of Spherical Triangles	96
	Napier's Analogies	101
	Solution of Oblique Spherical Triangles	102
	Applications	111

Formulæ; Plane Trigonometry 114

Spherical Trigonometry 116

Answers 119

PLANE TRIGONOMETRY.

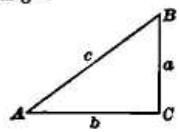
I. TRIGONOMETRIC FUNCTIONS OF ACUTE ANGLES.

1. Trigonometry treats of the properties and measurement of angles and triangles.

In *Plane Trigonometry* we consider *plane* figures only.

2. Definitions of the Trigonometric Functions of Acute Angles.

Let BAC be any acute angle.



From any point in either side, as B, draw a perpendicular to the other side, forming the right triangle ABC.

We then have the following definitions, applicable to either of the acute angles A or B:

In any right triangle,

The **sine** *of either acute angle is the ratio of the opposite side to the hypotenuse.*

The **cosine** *is the ratio of the adjacent side to the hypotenuse.*

The **tangent** *is the ratio of the opposite side to the adjacent side.*

The **cotangent** *is the ratio of the adjacent side to the opposite side.*

The **secant** *is the ratio of the hypotenuse to the adjacent side.*

The **cosecant** *is the ratio of the hypotenuse to the opposite side.*

We also have the following definitions:

The **versed sine** *of an angle is* 1 *minus the cosine of the angle.*

The **coversed sine** *is* 1 *minus the sine.*

The eight ratios defined above are called the *Trigonometric Functions* of the angle.