PLANE TRIGONOMETRY WITH PRACTICAL APPLICATIONS

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Plane Trigonometry with Practical Applications by Leonard E. Dickson

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PLANE TRIGONOMETRY

WITH PRACTICAL APPLICATIONS

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PREFACE

Distinctive features of this book are its immediate justification of the study of trigonometry, its emphasis on the practical applications, its sensible problems, its model solutions of sample problems, its concreteness, simplicity, and clearness, and its use of a traverse table in addition to the usual tables.

Trigonometry here justifies itself

The great majority of students of trigonometry, whether in the high school or the college, take it as their final course in mathematics. Hence the course should justify itself at the time, and not be merely a stepping stone to further mathematical subjects. Without overlooking the needs of the few who will go further in mathematics, we may justify trigonometry to the others by demonstrating its great utility by means of simple applications to various subjects which are vital in the practical world today.

Practical applications

This book introduces at an early stage concrete applications of trigonometry to the elementary parts of navigation and surveying, which are the two simplest exact sciences, as well as to the two elementary topics of physics which are known as composition of forces and refraction of light. There is, too, a full explanation of the theory and construction of a Mercator map, a subject of great importance also in geography. Three separate chapters are devoted to these subjects. The necessary terms and ideas are explained at length and illustrated concretely. We thereby obtain an abundance of simple problems whose importance is so convincing that they cannot fail to arouse real interest. Actual experience with classes has firmly convinced the author that these practical applications offer the best means to drive home the principles of trigonometry and to make the subject truly vital.

Sensible problems

The problems are simple and sensible. Puzzle problems have been discarded, as well as those serving no purpose beyond the scourge of endless computation. Instead of the usual dull problems calling for the solution of a triangle in which certain sides and angles are given, the problems here proposed are real and reflect some activity of actual life.

Sample problems solved The problems which present continuity of thought are collected into a set of exercises and given an appropriate descriptive heading. This plan will greatly aid the instructor in his selection of problems for assignment. Before each such collection of problems are inserted examples worked out in detail which together illustrate all of the different types of problems occurring in that collection. This feature will commend itself to both student and teacher. The harder problems (marked *) may be proposed for extra credit.

Concreteness Several informal illustrations of the tangent and sine are given prior to the formal definitions. The concrete information about angles of any size and their measurement, which is acquired in the chapters on navigation and surveying, furnishes a desirable background for the introduction of general angles. And the same is true as to familiarity with latitude and longitude before coördinates are introduced for the sake of defining the trigonometric functions of a general angle. But above all, the book is concrete on account of the practical applications included and the practical nature of the problems.

Simplicity Clearness The development of the subject is leisurely and the student is given ample time in which to digest each idea. There are given full and lucid explanations of all new terms and ideas. Lack of the precise knowledge of the mathematical meaning of terms is one of the chief sources of difficulty in the study of mathematics. Various terms which should already be familiar to students are re-defined. On the basis of careful readings both of the manuscript and proof sheets by various experienced teachers in high schools and colleges, it is believed that the presentation is throughout both simple and clear.

Tables The tables are as simple as possible, and accurate for computation to four significant figures, which are ample for all ordinary practical purposes. It is true that some delicate astronomical measurements justify computations with 5, 6, or 7 place tables; but no new theory is involved. The traverse table, which is necessary for navigation and surveying, is really a systematic list of the sides and angles of all right triangles of moderate size. Its additional headings aid in making the present exposition of navigation much simpler than was possible heretofore. The traverse table is extremely useful in all parts of trigonometry and its applications, partly by relieving the monotony of logarithmic computation, but chiefly for the instantaneous checking of computations.

A suggestion to teachers The chapters on navigation and surveying are each divided into two parts, this making possible either a brief, wholly untechnical, introduction to those applications, or a fuller treatment. When these chapters are reached, it is suggested that henceforth two hours a week be devoted to these applications and the remaining class periods to general trigonometry, which begins with page 103. Under this plan the student will be applying the theory of the right triangle, which he has already learned, while he is acquiring the theory of the oblique triangle, and will complete the former applications just when he is ready for the applications of the latter theory. Under such a program the student will understand at all times why he is doing what he is doing, will have real respect for the subject, and will take a genuine interest in it.

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