

**PLANE AND SPHERICAL  
TRIGONOMETRY  
IN THREE PARTS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649672264

Plane and Spherical Trigonometry in Three Parts by H. B. Goodwin

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](http://www.triestepublishing.com)

**H. B. GOODWIN**

**PLANE AND SPHERICAL  
TRIGONOMETRY  
IN THREE PARTS**



# TRIGONOMETRY

PLANE AND SPHERICAL

PLANE AND SPHERICAL  
TRIGONOMETRY

*IN THREE PARTS*

BY

H. B. GOODWIN, M.A.

NAVAL INSTRUCTOR, ROYAL NAVY

(PUBLISHED, UNDER THE SANCTION OF THE LORDS COMMISSIONERS OF  
THE ADMIRALTY, FOR USE IN THE ROYAL NAVY)

*EIGHTH IMPRESSION*

LONGMANS, GREEN, AND CO.

89 PATERNOSTER ROW, LONDON  
NEW YORK, BOMBAY, AND CALCUTTA

1907

*All rights reserved.*

PREFACE  
TO  
THE FOURTH EDITION.

---

As indicated in the original Preface, this treatise in the first instance was intended to serve as an introduction to the study of Navigation and Nautical Astronomy for the junior officers under training in H.M. Fleet.

Since, however, it has had the good fortune to secure a somewhat more extended circulation, the Author takes advantage of the production of the fourth edition to largely supplement the number of examples, both theoretical and practical, so that while more fully meeting the requirements of naval students, the work may at the same time be rendered more complete in itself, and therefore more available for general purposes.

The new examples, to the number of nearly three hundred and fifty, will be found in an Appendix at the end of the volume. They have been selected from the papers set in examinations held under the direction of the Royal Naval College during recent years, and will, it is hoped, afford a sufficient field of exercise for the student in all branches of the subject.

ROYAL NAVAL COLLEGE:  
*September 1893.*

357856

## PREFACE.

---

THE following pages have been compiled chiefly for the use of the junior officers of H.M. Fleet, in whose studies the subjects of Plane and Spherical Trigonometry, forming, as they do, the basis of the sciences of Navigation and Nautical Astronomy, must necessarily occupy a very important place.

Since the establishment of the Royal Naval College at Greenwich a considerable advance has been made in the standard of mathematical knowledge attained by the junior officers of the Fleet, and for some time the need of a suitable treatise upon Plane and Spherical Trigonometry has been making itself more and more apparent.

The text-books in Trigonometry commonly used in the Service of late years have been four in number, viz. Hamblin Smith's Plane Trigonometry, Todhunter's Spherical Trigonometry, Johnson's Trigonometry (used on board H.M.S. *Britannia*), and Jeans' Trigonometry (used chiefly afloat).

The inconvenience which must attend the use of so varied a list of text-books is obvious, and, to remedy this drawback, in the year 1884 the Lords Commissioners of the Admiralty were pleased to give their approval to the preparation of the present work.

The Author has endeavoured to include within the compass of a single volume as much of the more theoretical portions of Plane and Spherical Trigonometry as is required in the final



examination of acting sub-lieutenants at Greenwich, and at the same time not to lose sight of the special character which must belong to a work intended for naval students, in whose case the practical application of the logarithmic formulæ must necessarily be of paramount importance.

The book is divided into three parts, the third of which is devoted to the practical application of the various formulæ established in Parts I. and II.

In Part I., dealing with the theoretical portion of Plane Trigonometry, the ground covered is practically identical with the subject matter of the well-known manual of Hamblin Smith,—a work which has during the last ten years proved of great value as an elementary text-book.

Part II. contains as much of the theory of Spherical Trigonometry as is necessary to establish the various relations required in the solution of spherical triangles. This is a subject which has generally been found to present special difficulties to the young officer, because, on account of the early age at which he is compelled to give it his attention, he enters upon its study with a much smaller amount of mathematical knowledge than is possessed by those who take it up simply as a branch of their general education. An effort has therefore been made to exhibit the subject in its simplest form, and the chief purpose of its study by naval officers, viz. to serve as an introduction to the subject of Nautical Astronomy, has been kept steadily in view.

Part III., the practical portion of the work, consists, to a great extent, of the examples in the use of logarithms and in the solution of plane and spherical triangles, compiled by the late Mr. H. W. Jeans, formerly Mathematical Master at the Royal Naval College at Portsmouth. Jeans' Trigonometry has been in constant use in the Royal Navy for many years, and there seems reason to believe that the collection of examples given in that book has been found to answer satisfactorily the purposes for which it was intended.

The miscellaneous examples given at the end of Part III. as exercises in Practical Spherical Trigonometry, may perhaps be considered to belong rather to the sciences of Navigation and Nautical Astronomy; but, as no collection of such examples is to be found in any of the text-books in ordinary use afloat, the importance of these problems appears to justify their introduction here.

It will be observed that in the practical solution of triangles the cumbrous verbal rules which, in the darker days of naval education, were considered necessary, have been discarded, and the particular process of computation has been deduced directly from the appropriate formula in each case.

In obtaining the answers to the various practical problems the ordinary custom has been followed of looking out logarithms for the value given in the Tables which is nearest to the given angle, that is, in general, to the nearest 15".

The Author wishes to take this opportunity of thanking the several friends who have been good enough to assist him with criticism and suggestions. To the Rev. J. B. Harbord, Chaplain of the Fleet, the Rev. J. C. P. Aldous and the Rev. S. Kenah, of H.M.S. *Britannia*, and the Rev. J. L. Robinson, of the Royal Naval College, his acknowledgments are especially due.

ROYAL NAVAL COLLEGE, GREENWICH:

March 1886.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100