CAMBRIDGE LIBRARY COLLECTION

Books of enduring scholarly value

Mathematical Sciences

From its pre-historic roots in simple counting to the algorithms powering modern desktop computers, from the genius of Archimedes to the genius of Einstein, advances in mathematical understanding and numerical techniques have been directly responsible for creating the modern world as we know it. This series will provide a library of the most influential publications and writers on mathematics in its broadest sense. As such, it will show not only the deep roots from which modern science and technology have grown, but also the astonishing breadth of application of mathematical techniques in the humanities and social sciences, and in everyday life.

Principles of Geometry

Henry Frederick Baker (1866–1956) was a renowned British mathematician specialising in algebraic geometry. He was elected a Fellow of the Royal Society in 1898 and appointed the Lowndean Professor of Astronomy and Geometry in the University of Cambridge in 1914. First published between 1922 and 1925, the six-volume *Principles of Geometry* was a synthesis of Baker's lecture series on geometry and was the first British work on geometry to use axiomatic methods without the use of co-ordinates. The first four volumes describe the projective geometry of space of between two and five dimensions, with the last two volumes reflecting Baker's later research interests in the birational theory of surfaces. The work as a whole provides a detailed insight into the geometry which was developing at the time of publication. This, the second volume, describes the principal configurations of space of two dimensions.

Cambridge University Press has long been a pioneer in the reissuing of out-of-print titles from its own backlist, producing digital reprints of books that are still sought after by scholars and students but could not be reprinted economically using traditional technology. The Cambridge Library Collection extends this activity to a wider range of books which are still of importance to researchers and professionals, either for the source material they contain, or as landmarks in the history of their academic discipline.

Drawing from the world-renowned collections in the Cambridge University Library, and guided by the advice of experts in each subject area, Cambridge University Press is using state-of-the-art scanning machines in its own Printing House to capture the content of each book selected for inclusion. The files are processed to give a consistently clear, crisp image, and the books finished to the high quality standard for which the Press is recognised around the world. The latest print-on-demand technology ensures that the books will remain available indefinitely, and that orders for single or multiple copies can quickly be supplied.

The Cambridge Library Collection will bring back to life books of enduring scholarly value (including out-of-copyright works originally issued by other publishers) across a wide range of disciplines in the humanities and social sciences and in science and technology.

Principles of Geometry

Volume 2: Plane Geometry

H.F. Baker

Cambridge University Press

CAMBRIDGE UNIVERSITY PRESS

Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore,
São Paolo, Delhi, Dubai, Tokyo, Mexico City

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9781108017787

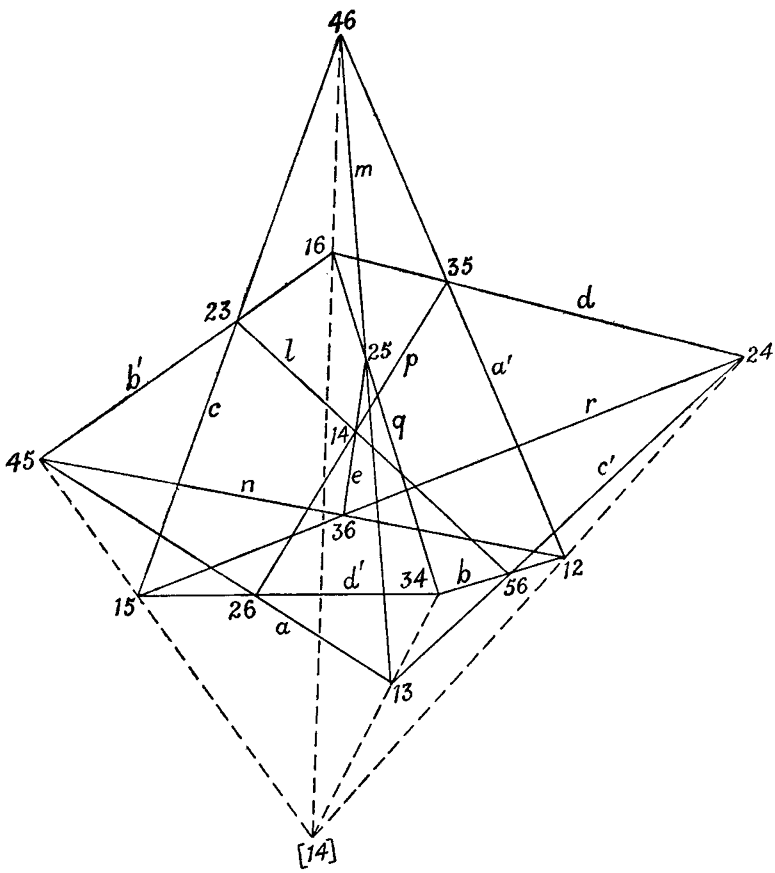
This edition first published 1922
This digitally printed version 2010

ISBN 978-1-108-01778-7 Paperback

PRINCIPLES OF GEOMETRY

CAMBRIDGE UNIVERSITY PRESS
C. F. CLAY, MANAGER
LONDON : FETTER LANE, E.C. 4

LONDON : H. K. LEWIS AND CO., LTD.,
136, Gower Street, W.C. 1
NEW YORK : THE MACMILLAN CO.
BOMBAY
CALCUTTA } MACMILLAN AND CO., LTD.
MADRAS
TORONTO : THE MACMILLAN CO. OF CANADA, LTD.
TOKYO : MARUZEN-KABUSHIKI-KAISHA



HEXAGRAMMUM MYSTICUM
(see p. 219)

PRINCIPLES OF GEOMETRY

BY

H. F. BAKER, Sc.D., F.R.S.,

LOWNDEAN PROFESSOR OF ASTRONOMY AND GEOMETRY, AND FELLOW OF
ST JOHN'S COLLEGE, IN THE UNIVERSITY OF CAMBRIDGE

VOLUME II

PLANE GEOMETRY

CONICS, CIRCLES, NON-EUCLIDEAN GEOMETRY

In minimis maxima

CAMBRIDGE
AT THE UNIVERSITY PRESS
1922

PRINTED IN GREAT BRITAIN

PREFACE

THE present volume has in effect two aims: In the first place, in pursuance of the general purpose of the book, it seeks to put the reader in touch with the main preliminary theorems of plane geometry. Chapter I is devoted to a deduction, with synthetic methods, of the fundamental properties of conic sections; it is an introduction to what is usually called Projective Geometry, in the plane, in which, however, the notions of distance and congruence are not assumed. Chapter II, also without help of these notions, develops results that arise by considering conics in relation to two Absolute points, including, for instance, the properties of circles, and of confocal conics; the matter here contained is usually found in sequels to Euclid, books on Pure Geometry, and books on Geometrical Conics. Chapter III is designed to explain the application of the algebraic symbols to plane geometry; it contains methods and formulae found in works on Analytical Geometry of the Plane. Chapter IV is a brief consideration of some logical questions, and marks the recognition of a limitation in the symbols employed; it deals with the sense in which the words real and imaginary are used, and calls attention to the elements of Analysis assumed in the following chapter. Chapter V deals with the theory of measurement, of length and angle, with the help of an Absolute conic, shewing how the so-called non-Euclidean geometries may be regarded as included in our general formulation. It considers the metrical plane also as deduced from the geometry of a quadric surface, incidentally dealing with the fundamental properties of this surface and, in particular, with Spherical Trigonometry. As a corollary from this point of view, Riemann's space of constant curvature is seen not to require the assumption of absolute coordinates; and further, that form of the hyperbolic geometry in which lines are replaced by circles cutting a fixed circle at right angles (which, for instance, was an inspiration to Poincaré in his development of the theory of automorphic functions) is seen to arise naturally. Notes I and II deal with the theorems of incidence which were developed very gradually for the complete Pascal figure and appeared very intricate; from the point of view here explained they are natural, if particular, properties of a figure which arises otherwise, and will much concern us in a later volume. Note III gives some indications of the literature of non-Euclidean geometry. Note IV contains remarks and corrections for Volume I, for many of which I am indebted to friends. There is also an Index; but it is possible that the extensive Table of Contents may be more useful. No attempt is made to give a general Bibliography for the contents of the volume.

It will be seen that the volume deals with a wide range of theory; in other conditions than the present, a less condensed treatment might have been desirable. The order in which the ideas are taken has been chosen largely in view of the second aim of the volume; it will not be difficult, with the help of the Table of Contents, for the reader to modify this order. It is believed, however, that a large amount of the time usually spent, at present, in learning geometry, could be saved by following, from the beginning, after an extensive study of diagrams and models, the order of development here adopted; and such a plan would make much less demand upon the memory.

But the second aim of the volume may, I hope, appeal to attentive readers. It is an attempt, tempered indeed by practical considerations, to test the application in detail of the logical principles explained in Volume I. It seeks to bring to light the assumptions which underlie an extensive literature in which coordinates are freely used without attempt at justification. It suggests the question whether, in the case of distance, as in many other cases, we may not have derived from familiarity with physical experiences, a confidence which a more careful scrutiny can only regard as an illusion. When this view, which seems sure, shall win acceptance, the change in scientific thought will be rapid and momentous. As the first step in this sense was made in the development of the theory of our geometrical conceptions, it is proper that the matter should be dealt with here. It will be of importance if the reader come to see how deep lying are the questions involved in the use of coordinates, and the assumption of distance as a fundamental idea.

As in the case of the first volume, I desire to express my thanks to the Staff of the University Press for their care and courtesy, and to Mr J. B. Peace, M.A., for the great trouble he has taken with the numerous diagrams.

H. F. B.

2 *September* 1922

TABLE OF CONTENTS

PRELIMINARY

CHAPTER I. GENERAL PROPERTIES OF CONICS

CHAPTER II. PROPERTIES RELATIVE TO TWO POINTS OF REFERENCE

CHAPTER III. THE EQUATION OF A LINE, AND OF A CONIC

Cambridge University Press
978-1-108-01778-7 - Principles of Geometry, Volume 2
H. F. Baker
Frontmatter
More information

CHAPTER IV. RESTRICTION OF THE ALGEBRAIC SYMBOLS. THE DISTINCTION OF REAL AND IMAGINARY ELEMENTS

CHAPTER V. PROPERTIES RELATIVE TO AN ABSOLUTE CONIC. THE NOTION OF DISTANCE. NON-EUCLIDEAN GEOMETRY

NOTE I. ON CERTAIN ELEMENTARY CONFIGURATIONS, AND ON THE COMPLETE FIGURE FOR PAPPUS' THEOREM

NOTE II. ON THE *HEXAGRAMMUM MYSTICUM* OF PASCAL