

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.

The Collected Mathematical Papers

Arthur Cayley (1821-1895) was a key figure in the creation of modern algebra. He studied mathematics at Cambridge and published three papers while still an undergraduate. He then qualified as a lawyer and published about 250 mathematical papers during his fourteen years at the Bar. In 1863 he took a significant salary cut to become the first Sadleirian Professor of Pure Mathematics at Cambridge, where he continued to publish at a phenomenal rate on nearly every aspect of the subject, his most important work being in matrices, geometry and abstract groups. In 1882 he spent five months at Johns Hopkins University, and in 1883 he became president of the British Association for the Advancement of Science. Publication of his Collected Papers - 967 papers in 13 volumes plus an index volume - began in 1889 and was completed after his death under the editorship of his successor in the Sadleirian Chair. Volume 3 contains 64 papers first published between 1857 and 1862.

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 across a wide range of disciplines in the humanities and social sciences and in science and technology.

The Collected Mathematical Papers

VOLUME 3

ARTHUR CAYLEY

Cambridge University Press
978-1-108-00495-4 - The Collected Mathematical Papers, Volume 3
Arthur Cayley
Frontmatter
[More information](#)

CAMBRIDGE UNIVERSITY PRESS

Cambridge New York Melbourne Madrid Cape Town Singapore São Paulo Delhi

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

www.cambridge.org

Information on this title: www.cambridge.org/9781108004954

© in this compilation Cambridge University Press 2009

This edition first published 1890

This digitally printed version 2009

ISBN 978-1-108-00495-4

This book reproduces the text of the original edition. The content and language reflect the beliefs, practices and terminology of their time, and have not been updated.

MATHEMATICAL PAPERS.

Cambridge University Press
978-1-108-00495-4 - The Collected Mathematical Papers, Volume 3
Arthur Cayley
Frontmatter
[More information](#)

London: C. J. CLAY & SONS,
CAMBRIDGE UNIVERSITY PRESS WAREHOUSE,
AVE MARIA LANE.



Cambridge: DEIGHTON, BELL AND CO.
Leipzig: F. A. BROCKHAUS.

THE COLLECTED

MATHEMATICAL PAPERS

OF

ARTHUR CAYLEY, Sc.D., F.R.S.,

SADLERIAN PROFESSOR OF PURE MATHEMATICS IN THE UNIVERSITY OF CAMBRIDGE.

VOL. III.

CAMBRIDGE :
AT THE UNIVERSITY PRESS.

1890

[All Rights reserved.]

Cambridge University Press
978-1-108-00495-4 - The Collected Mathematical Papers, Volume 3
Arthur Cayley
Frontmatter
[More information](#)

CAMBRIDGE :
PRINTED BY C. J. CLAY, M.A. AND SONS,
AT THE UNIVERSITY PRESS.

ADVERTISEMENT.

THE present volume contains 64 papers numbered 159 to 222 originally published in the years 1857 to 1862: the chronological order is slightly departed from for the sake of including a series of papers in the Memoirs and the Monthly Notices of the Royal Astronomical Society: there are thus some earlier papers which have been left over for the next volume.

As papers are referred to by their Numbers only it will be convenient to give in each volume a Table such as the following:

Vol. I.	Numbers	1	to	100.
„ II.	„	101	„	158.
„ III.	„	159	„	222.

CONTENTS.

[An Asterisk denotes that the Paper is not printed in full.]

	PAGE
159. <i>On some Integral Transformations</i>	1
Quart. Math. Jour. t. i. (1857), pp. 4—6	
160. <i>On a Theorem relating to Reciprocal Triangles</i>	5
Quart. Math. Jour. t. i. (1857), pp. 7—10	
161. <i>A problem in Permutations</i>	8
Quart. Math. Jour. t. i. (1857), p. 79	
162. <i>Two letters on Cubic Forms</i>	9
Quart. Math. Jour. t. i. (1857), pp. 85—87 and 90—91	
163. <i>On Hansen's Lunar Theory</i>	13
Quart. Math. Jour. t. i. (1857), pp. 112—125	
164. <i>On Gauss' Theory for the Attraction of Ellipsoids</i>	25
Quart. Math. Jour. t. i. (1857), pp. 162—166	
165. <i>On some Geometrical Theorems relating to a triangle circum- scribed about a Conic</i>	29
Quart. Math. Jour. t. i. (1857), pp. 169—175	
166. <i>Note on the Homology of Sets</i>	35
Quart. Math. Jour. t. i. (1857), p. 178	
167. <i>Apropos of Partitions</i>	36
Quart. Math. Jour. t. i. (1857), pp. 183—184	
C. III.	<i>b</i>

	PAGE
*168. <i>A demonstration of the Fundamental Property of Geodesic Lines</i>	38
Quart. Math. Jour. t. I. (1857), pp. 185—186	
169. <i>Eisenstein's Geometrical Proof of the Fundamental Theorem for Quadratic Residues (Translated from the Original Memoir, Crelle, t. XXVIII. (1844), with an addition by A. Cayley)</i> .	39
Quart. Math. Jour. t. I. (1857), pp. 186—191	
170. <i>On Schellbach's Solution of Malfatti's Problem</i>	44
Quart. Math. Jour. t. I. (1857), pp. 222—226	
171. <i>Note on Mr Salmon's Equation of the Orthotomic Circle</i>	48
Quart. Math. Jour. t. I. (1857), pp. 242—244	
172. <i>Note on the Logic of Characteristics</i>	51
Quart. Math. Jour. t. I. (1857), pp. 257—259	
173. <i>On Laplace's Method for the Attraction of Ellipsoids</i>	53
Quart. Math. Jour. t. I. (1857), pp. 285—300	
*174. <i>On the Oval of Descartes</i>	66
Quart. Math. Jour. t. I. (1857), pp. 320—328	
175. <i>On the Porism of the In-and-circumscribed Triangle</i>	67
Quart. Math. Jour. t. I. (1857), pp. 344—354	
176. <i>Note on Jacobi's Canonical Formulæ for Disturbed Motion in an Elliptic Orbit</i>	76
Quart. Math. Jour. t. I. (1857), pp. 355—356	
177. <i>Solution of a Mechanical Problem</i>	78
Quart. Math. Jour. t. I. (1857), pp. 405—406	
178. <i>On the à posteriori Demonstration of the Porism of the In-and-circumscribed Triangle</i>	80
Quart. Math. Jour. t. II. (1858), pp. 31—38	
179. <i>On certain Forms of the Equation of a Conic</i>	86
Quart. Math. Jour. t. II. (1858), pp. 44—48	

CONTENTS.		ix
		PAGE
180.	<i>Note on the Reduction of an Elliptic Orbit to a fixed plane</i> . Quart. Math. Jour. t. II. (1858), pp. 49—54	91
181.	<i>On Sir W. R. Hamilton's Method for the Problem of three or more Bodies</i> Quart. Math. Jour. t. II. (1858), pp. 66—73	97
182.	<i>On Lagrange's Solution of the Problem of two fixed Centres</i> . Quart. Math. Jour. t. II. (1858), pp. 76—83	104
183.	<i>Note on Certain Systems of Circles</i> Quart. Math. Jour. t. II. (1858), pp. 83—88	111
184.	<i>A Theorem relating to Surfaces of the Second Order</i> Quart. Math. Jour. t. II. (1858), pp. 140—142	115
185.	<i>Note on the 'Circular Relation' of Prof. Möbius</i> Quart. Math. Jour. t. II. (1858), p. 162	118
186.	<i>On the determination of the value of a certain Determinant</i> . Quart. Math. Jour. t. II. (1858), pp. 163—166	120
187.	<i>On the Sums of Certain Series arising from the Equation</i> $x = u + tfx$ Quart. Math. Jour. t. II. (1858), pp. 167—171	124
188.	<i>On the Simultaneous Transformation of two Homogeneous Functions of the Second Order</i> Quart. Math. Jour. t. II. (1858), pp. 192—195	129
189.	<i>Note on a formula in finite Differences</i> Quart. Math. Jour. t. II. (1858), pp. 198—201	132
190.	<i>On the System of Conics which pass through the same four points</i> Quart. Math. Jour. t. II. (1858), pp. 206—207	136
191.	<i>Note on the Expansion of the true Anomaly</i> Quart. Math. Jour. t. II. (1858), pp. 229—232	139

	PAGE
192. <i>On the Area of the Conic Section represented by the General Trilinear Equation of the Second Degree</i>	143
Quart. Math. Jour. t. II. (1858), pp. 248—253	
193. <i>On Rodrigues' Method for the Attraction of Ellipsoids</i>	149
Quart. Math. Jour. t. II. (1858), pp. 333—337	
194. <i>Note on the Theory of Attraction</i>	154
Quart. Math. Jour. t. II. (1858), pp. 338, 339	
195. <i>Note on the Recent Progress of Theoretical Dynamics</i>	156
Report of British Association, 1857, pp. 1—42	
196. <i>Note sur un Problème d'Analyse Indéterminée</i>	205
Nouvelles Annales de Math. t. XVI. (1857), pp. 161—165	
197. <i>Note on the Theory of Logarithms</i>	208
Phil. Mag. t. XI. (1856), pp. 275—280	
198. <i>Note on a Result of Elimination</i>	214
Phil. Mag. t. XI. (1856), pp. 378—379	
199. <i>Note on the Theory of Elliptic Motion</i>	216
Phil. Mag. t. XI. (1856), pp. 425—428	
200. <i>On the Cones which pass through a given Curve of the Third Order in Space</i>	219
Phil. Mag. t. XII. (1856), pp. 20—22	
201. <i>Second Note on the Theory of Logarithms</i>	222
Phil. Mag. t. XII. (1856), pp. 354—360	
202. <i>Supplementary Remarks on the Porism of the In-and-circumscribed Triangle</i>	229
Phil. Mag. t. XIII. (1857), pp. 19—30	
203. <i>On the Theory of the Analytical Forms called Trees</i>	242
Phil. Mag. t. XIII. (1857), pp. 172—176	
204. <i>On a Problem in the Partition of Numbers</i>	247
Phil. Mag. t. XIII. (1857), pp. 245—248	

CONTENTS.		xi
		PAGE
205.	<i>Note on the Summation of a Certain Factorial Expression</i>	250
	Phil. Mag. t. XIII. (1857), pp. 419—423	
206.	<i>Note on a Theorem relating to the Rectangular Hyperbola</i>	254
	Phil. Mag. t. XIII. (1857), p. 423	
207.	<i>Analytical Solution of the Problem of Tactions</i>	255
	Phil. Mag. t. XIII. (1857), pp. 507—509	
208.	<i>Note on the Equipotential Curve $\frac{m}{r} + \frac{m'}{r'} = C$.</i>	258
	Phil. Mag. t. XIV. (1857), pp. 142—146	
209.	<i>A Demonstration of Sir W. R. Hamilton's Theorem of the Isochronism of the Circular Hodograph</i>	262
	Phil. Mag. t. XIV. (1857), pp. 427—430	
210.	<i>On the Cubic Transformation of an Elliptic Function</i>	266
	Phil. Mag. t. XV. (1858), pp. 363—364	
211.	<i>On a Theorem relating to Hypergeometric Series</i>	268
	Phil. Mag. t. XVI. (1858), pp. 356, 357	
212.	<i>A Memoir on the Problem of Disturbed Elliptic Motion</i>	270
	Mem. R. Astron. Soc. t. XXVII. (1859), pp. 1—29	
213.	<i>On the Development of the Disturbing Function in the Lunar Theory</i>	293
	Mem. R. Astron. Soc. t. XXVII. (1859), pp. 69—95	
214.	<i>The First part of a Memoir on the Development of the Disturbing Function in the Lunar and Planetary Theories</i>	319
	Mem. R. Astron. Soc. t. XXVIII. (1860), pp. 187—215	
215.	<i>A Supplementary Memoir on the Problem of Disturbed Elliptic Motion</i>	344
	Mem. R. Astron. Soc. t. XXVIII. (1860), pp. 217—234	

	PAGE
216. <i>Tables of the Development of Functions in the Theory of Elliptic Motion</i>	360
Mem. R. Astron. Soc. t. xxix. (1861), pp. 191—306	
217. <i>A Memoir on the Problem of the Rotation of a solid Body</i>	475
Mem. R. Astron. Soc. t. xxix. (1861), pp. 307—342	
218. <i>A Third Memoir on the Problem of Disturbed Elliptic Motion</i>	505
Mem. R. Astron. Soc. t. xxxi. (1863), pp. 43—56	
219. <i>On some formulae relating to the Variation of the Plane of a Planet's Orbit</i>	516
Monthly Notices R. Astron. Soc. t. xxi. (1861), pp. 43—46	
220. <i>Note on a Theorem of Jacobi's in relation to the Problem of Three Bodies</i>	519
Monthly Notices R. Astron. Soc. t. xxii. (1862), pp. 76—78	
221. <i>On the Secular Acceleration of the Moon's Mean Motion</i>	522
Monthly Notices R. Astron. Soc. t. xxii. (1862), pp. 173—230	
222. <i>On Lambert's Theorem for Elliptic Motion</i>	562
Monthly Notices R. Astron. Soc. t. xxii. (1862), pp. 238—242	

<i>Notes and References</i>	567

CLASSIFICATION.

GEOMETRY

Circles, Conics and Quadric Surfaces, 170, 171, 179, 183, 184, 190, 192, 206, 207
 Malfatti's Problem, 170
 Problem of Tactions, 207
 In-and-Circumscribed Triangle, 165, 175, 178, 202
 Reciprocal Triangles, 160
 Homology of Sets, 166
 Geodesic Lines, 168
 Cartesians, 174
 Circular relation of Möbius, 185
 Cones through Cubic Curve, 200
 Equipotential Curve, 208

ANALYSIS

Attractions, 164, 173, 193, 194
 Dynamics
 Report on Progress of Theoretical Dynamics, 195
 Hansen's Lunar Theory, 163
 Jacobi's Canonical Formulæ, 176
 Plane of Elliptic Orbit, 180, 219
 Problem of two fixed Centres, 182
 Hamilton's Method for three or more Bodies, 181
 Elliptic Motion, 191, 192, 199, 222; Disturbed, 212, 215, 218; Tables, 216
 Hamilton's Circular Hodograph, 209
 Disturbing Function in Lunar and Planetary Theories, 213, 214
 Theorem of Jacobi's, 220
 Secular Acceleration of Moon, 221
 Rotation of Solid Body, 217

ANALYSIS

- Elliptic Functions, 210
- Transformation of two Quadric Functions, 188
- Integral Transformations, 159
- Permutations, 161
- Binary Cubic Forms, 162
- Partitions, 167, 204; Trees, 203
- Quadratic Residues, 169
- Logic of Characteristics, 172
- Mechanical Problem, 177
- Special Determinant, 186
- Sums of Certain Series, 187
- Formula in Finite Differences, 189
- Indeterminate Analysis, 196
- Theory of Logarithms, 197, 201
- Elimination, 198
- Hypergeometric Series, 205, 211