

Kiselev's
GEOMETRY

Book II. STEREOMETRY

by
A. P. Kiselev

Adapted from Russian
by Alexander Givental



Sumizdat



Published by Sumizdat

5426 Hillside Avenue, El Cerrito, California 94530, USA

<http://www.sumizdat.org>

University of California, Berkeley Cataloging-in-Publication Data

Kiselev, A. (Andrei Petrovich)

Geometriia. Chast 2, Stereometriia. English

Kiselev's Geometry. Book II, Stereometry / by A.P. Kiselev ;

adapted from Russian by Alexander Givental.

El Cerrito, Calif. : Sumizdat, 2008.

iv, 180 p. : ill. ; 23 cm.

Includes bibliographical references and index.

ISBN 978-0-9779852-1-0

1. Geometry. 2. Geometry, Solid. I. Givental, Alexander.

QA453.K57313 2008

Library of Congress Control Number: 2008931141

©2008 by Alexander Givental

All rights reserved. Copies or derivative products of the whole work or any part of it may not be produced without the written permission from Alexander Givental (givental@math.berkeley.edu), except for brief excerpts in connection with reviews or scholarly analysis.

Credits

Editing: Alisa Givental.

Consulting: Thomas Rike, Math Department, Oakland High School.

Linguistic advice: Ralph Raimi,

Department of Mathematics, The University of Rochester.

Front cover features art photography © by Svetlana Tretyakova.

Art advising: Irina Mukhacheva, <http://irinartstudio.com>

Copyright advising: Ivan Rothman, attorney-at-law.

Cataloging-in-publication: Catherine Moreno,

Technical Services Department, Library, UC Berkeley.

Layout, typesetting and graphics: using $L^A_T E X$ and *Xfig*.

Printing and binding: *Thomson-Shore, Inc.*, <http://www.tshore.com>

Member of the Green Press Initiative.

7300 West Joy Road, Dexter, Michigan 48130-9701, USA.

Offset printing on 30% recycled paper; cover: by 4-color process on Kivar-7.

ISBN 978-0-9779852-1-0

Contents

1	LINES AND PLANES	1
1	Drawing a plane	1
2	Parallel lines and planes	3
3	Perpendiculars and slants	9
4	Dihedral and some other angles	16
5	Polyhedral angles	23
2	POLYHEDRA	29
1	Parallelepipeds and pyramids	29
2	Volumes of prisms and pyramids	39
3	Similarity of polyhedra	51
4	Symmetries of space figures	59
5	Regular polyhedra	66
3	ROUND SOLIDS	75
1	Cylinders and cones	75
2	The ball	88
4	VECTORS AND FOUNDATIONS	107
1	Algebraic operations with vectors	107
2	Applications of vectors to geometry	117
3	Foundations of geometry	128
4	Introduction to non-Euclidean geometry	141
5	Isometries	154
	AFTERWORD	163
	BIBLIOGRAPHY	171
	INDEX	172

The present volume completes the English adaptation of *Kiselev's Geometry*. The first volume, *Planimetry*, was published as [4] (see section Bibliography) and will be referred to as *Book I*. The reader is directed to Translator's Foreword in Book I for background information on the original work [5, 6]. Preparing Book II, I added about 250 exercises, expanded the sections on Similarity of polyhedra, Symmetries of space figures and Regular polyhedra, and wrote a new, last chapter. It contains a geometric approach to vectors, followed by a vector approach to logical foundations of geometry, and concludes with a constructive introduction into non-Euclidean plane geometry. While some accounts of such topics are certainly expected of every modern course in elementary geometry, any specific choices may have non-obvious mathematical and pedagogical implications. Some of them are explained in Translator's Afterword *Three controversies about mathematics, geometry, and education*.

Alexander Givental
Department of Mathematics
University of California Berkeley
July, 2008

Authors cited in this book:

<i>Plato</i>	427 – 347 B.C.
<i>Euclid of Alexandria</i>	about 325 – 265 B.C.
<i>Archimedes of Syracuse</i>	287 – 212 B.C.
<i>Menelaus of Alexandria</i>	about 70 – 140 A.D.
<i>Pappus of Alexandria</i>	about 290 – 350 A.D.
<i>Johannes Kepler</i>	1571 – 1630
<i>Gérard Desargues</i>	1591 – 1661
<i>Bonaventura Cavalieri</i>	1598 – 1647
<i>Giovanni Ceva</i>	1647 – 1734
<i>Augustin Louis Cauchy</i>	1789 – 1857
<i>Nikolai Lobachevsky</i>	1792 – 1856
<i>János Bolyai</i>	1802 – 1860
<i>Arthur Cayley</i>	1821 – 1895
<i>Bernhard Riemann</i>	1826 – 1866
<i>Eugeneo Beltrami</i>	1835 – 1899
<i>Hermann Schwarz</i>	1843 – 1921
<i>Georg Cantor</i>	1845 – 1918
<i>Felix Klein</i>	1849 – 1925
<i>David Hilbert</i>	1862 – 1943
<i>Hermann Minkowski</i>	1864 – 1909
<i>Max Dehn</i>	1878 – 1952
<i>Albert Einstein</i>	1879 – 1955
<i>Hermann Weyl</i>	1885 – 1955