

ELEMENTS OF PLANE GEOMETRY

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649106813

Elements of plane geometry by Alan Sanders

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

ALAN SANDERS

**ELEMENTS OF
PLANE GEOMETRY**

ELEMENTS
OF
PLANE GEOMETRY

BY
ALAN SANDERS
HUGHES HIGH SCHOOL, CINCINNATI, OHIO



NEW YORK · CINCINNATI · CHICAGO
AMERICAN BOOK COMPANY

COPYRIGHT, 1901, BY
AMERICAN BOOK COMPANY.

ENTERED AT STATIONERS' HALL, LONDON.

SANDERS' PLANE GEOM.

E-P 2

PURPOSE AND DISTINCTIVE FEATURES

THIS work has been prepared for the use of classes in high schools, academies, and preparatory schools. Its distinctive features are:—

1. *The omission of parts of demonstrations.*

By this expedient the student is forced to rely more on his own reasoning powers, and is prevented from acquiring the detrimental habit of memorizing the text.

As it is necessary for the beginner in Geometry to learn the *form* of a geometrical demonstration, the demonstrations of the first few propositions are given in full. In the succeeding propositions only the most obvious steps are omitted, the omission in each case being indicated by an interrogation mark (?). In no case is the student expected to originate the *plan* of proof.

2. *The introduction, after each proposition, of exercises bearing directly upon the principle of the proposition.*

As soon as a proposition has been mastered, the student is required to apply its principle in the solution of a series of easy exercises. Hints or suggestions are given to aid the pupil in the solution of the more difficult exercises.

3. *All constructions, such as drawing parallels, erecting perpendiculars, etc., are given before they are required to be used in demonstrations.*

4. *Exercises in Modern Geometry.*

Exercises involving the principles of Modern Geometry are given under their proper propositions. As the omission of these exercises cannot affect the sequence of propositions, they may be disregarded at the discretion of the teacher.

5. *Propositions and converses.*

Whenever possible, the converse of a proposition is given with the proposition itself.

6. *Number of exercises.*

Besides the exercises directly following each proposition, miscellaneous exercises are given at the end of each book. It may be found that there are more exercises given than can be covered by a class in the time allotted to the subject of Plane Geometry; in which case the teacher will have to select from the lists given.

While the exercises have been drawn from many sources, the author has availed himself in particular of the recent entrance examination papers of the best American colleges and scientific schools.

The author wishes to express his obligations to his colleagues in the Cincinnati High Schools for their criticism and encouragement, and especially to Miss Celia Doerner of Hughes High School for valuable suggestions and for her painstaking reading of the proof.

CONTENTS

	PAGE
PRELIMINARY DEFINITIONS	9
AXIOMS	12
POSTULATES	13
SYMBOLS AND ABBREVIATIONS	14

BOOK I

RECTILINEAR FIGURES	15
ADDITIONAL EXERCISES	71

BOOK II

CIRCLES	79
ADDITIONAL EXERCISES	122

BOOK III

PROPORTIONS — SIMILAR POLYGONS	129
ADDITIONAL EXERCISES	173

BOOK IV

AREAS OF POLYGONS	181
ADDITIONAL EXERCISES	213

BOOK V

MEASUREMENT OF THE CIRCLE	220
ADDITIONAL EXERCISES	243

INDEX OF MATHEMATICAL TERMS

[The references are to articles]

- Abbreviations, list of, 29
Acute angle, 17
Adjacent angles, 15
Alternate exterior angles, 113
Alternate interior angles, 113
Alternation, in proportion, 416
Altitude, of parallelogram, 561
 of trapezoid, 561
 of triangle, 194
Analysis, 246
Angle, 13
 acute, 17
 at center of a regular polygon, 716
 degree of, 347
 inscribed, 354
 oblique, 17
 obtuse, 17
 right, 16
 sides of, 13
 vertex of, 13
Angles, adjacent, 15
 alternate exterior, 113
 alternate interior, 113
 complementary, 66
 corresponding, 113
 exterior, 113
 homologous, 544
 interior, 113
 opposite, 75
 supplementary, 65
 vertical, 75
Antecedents, in proportion, 404
Apothem, 716
Arc, 21
 degree of, 347
Area, 561
Axiom, 27
Axioms, list of, 27
Base, of isosceles triangle, 50
 of parallelogram, 561
 of polygon, 561
 of trapezoid, 561
Center, of circle, 19
 of regular polygon, 716
 of similitude, 556
Chord, 247
Circle, 19
 angle inscribed in, 354
 center of, 19
 circumference of, 19
 diameter of, 20
 inscribed in polygon, 247
 radius of, 20
 sector of, 343
 segment of, 354
 tangent to, 306
Circumscribed circle, 247
 polygon, 247
Commensurable quantities, 342
Complementary angles, 66
Composition and division, 430
Composition, in proportion, 421
Conclusion, 22
Concurrent lines, 601
Consequents, in proportion, 404
Constant, 340
Continued proportion, 442
Converse, 72
Corollary, 25
Corresponding angles, 113
Curved line, 7
Decagon, 152
Degree, of angle, 347
 of arc, 347

- Determination of straight line, 246
 Diagonal, 152
 Diameter, 20
 Direct tangent, 556
 Distance, from point to line, 223
 from point to point, 223
 Division, external, 506
 in proportion, 427
 internal, 506
 Dodecagon, 152

 Equiangular polygon, 152
 triangle, 18
 Equilateral polygon, 152
 triangle, 18
 Equivalent polygons, 561
 Exterior angles, 113
 External division, 506
 Extreme and mean ratio, 551
 Extremes, in proportion, 404

 Fourth proportional, 404

 Geometrical figures, 9
 Geometry, 11
 plane, 12

 Harmonical division, 509
 pencil, 512
 Hexagon, 152
 Homologous angles, 544
 sides, 544
 Hypotenuse, 43
 Hypothesis, 22

 Incommensurable quantities, 342
 Indirect proof, 39
 Inscribed angle, 354
 circle, 395
 Interior angles, 113
 Inversion in proportion, 419
 Isosceles triangle, 18
 Isosceles triangle, base of, 50
 vertex of, 50

 Left side, of angle, 130
 Legs, of right triangle, 43
 Limit, 340
 Line, 4
 curved, 7
 straight, 6
 Lines, parallel, 107
 perpendicular, 16
 Locus, 233

 Material body, 1
 Mean proportional, 404
 Means, of a proportion, 404
 Median of a triangle, 173
 Minutes, of arc, 347
 Mutually equiangular triangles, 137

 Oblique angle, 17
 Obtuse angle, 17
 Octagon, 152

 Parallel lines, 107
 Parallelogram, 194
 altitude of, 561
 bases of, 561
 Pentagon, 152
 Pentedecagon, 152
 Perimeter of polygon, 152
 Perpendicular lines, 16
 Plane surface, 8
 angle, 13
 figure, 10
 geometry, 12
 Point, 5
 Polar, 521
 Pole, 521
 Polygon, 152
 circumscribed, 395
 diagonal of, 152
 inscribed, 247
 perimeter of, 152
 regular, 152
 Polygons, similar, 477