ELEMENTS OF DESCRIPTIVE GEOMETRY: WITH APPLICATIONS TO SPHERICAL AND ISOMETRIC PROJECTIONS, SHADES AND SHADOWS, AND PERSPECTIVE

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Trieste

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DESCRIPTIVE GEOMETRY

WITH APPLICATIONS TO

SPHERICAL AND ISOMETRIC PROJECTIONS, SHADES AND SHADOWS, AND PERSPECTIVE

BY

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PREFACE

CHURCH'S "Elements of Descriptive Geometry" was originally published in 1864. The preface to the first edition states: "Without any effort to enlarge or originate, the author has striven to give, with a natural arrangement and in clear and concise language, the elementary principles and propositions of this branch of science, of so much interest to the mathematical student, and so necessary to both the civil and military engineer."

Professor Church succeeded so well in his efforts to produce a practical and well-adapted treatise that it has continued in use as a text-book for more than forty years in the United States Military Academy and in many other academies, technical schools, and colleges. This long-continued use of the book speaks well for its high intrinsic excellence.

During the last few years, however, there have taken place many changes in the methods of teaching the subject, and in the problems required. To meet these new demands the present volume is issued. In its preparation much of Professor Church's text has been used, and his concise and lucid style has been preserved.

Among the salient features of the present work are the following:

The *figures* and *text* are included in the same volume.

General cases are preferred to special ones.

A sufficient number of problems are solved in the *third angle* to familiarize the student with its use.

A treatment of the *profile plane* of projection is introduced.

Many *exercises for practice* have been introduced.

Several *new problems* have been added.

The *old figures have been redrawn*, and many of them have been improved.

Several of the more difficult elementary problems have been illustrated by *pictorial views*.

In the treatment of *curved surfaces*, all problems relating to single-curved surfaces are taken up first, then those relating to warped surfaces, and finally those relating to surfaces of revolution. Experience proves this order to be a logical one, as we here proceed "from the simple to the more complex." Also the student is more quickly prepared for drawing-room work on intersections and developments; and in case it is desired to abbreviate the course by omitting warped surfaces, the remaining problems will be found to be consecutively arranged.

The writer here wishes to acknowledge his indebtedness to the many teachers who have aided him with valuable advice and suggestions in relation to this work. In particular his thanks are due to his esteemed colleagues, Professor H. J. Goulding and Mr. D. E. Foster of the University of Michigan, for their careful reading and correction of the manuscript.

G. M. B.

MAY 14, 1910.

CONTENTS

PART I

ORTHOGRAPHIC PROJECTIONS

	PAGE
Preliminary Definitions	7
Representation of Points	9
Representation of Planes	11
Representation of Straight Lines	11
Propositions relating to the Point, Line, and Plane	12
Rotation of the Horizontal Plane	17
Notation used in the Description of Drawings	19
Exercises for Practice	21
The Profile Plane of Projection	25
Elementary Problems relating to the Point, Line, and Plane	28
Classification of Lines	63
Projection of Curves	64
Tangents and Normals to Lines	65
Construction of Certain Plane Curves	69
The Helix. Generation and Properties	73
Generation and Classification of Surfaces	77
Cylindrical Surfaces. Generation and Properties	78
Conical Surfaces. Generation and Properties	81
Planes Tangent to Surfaces in General	84
Planes Tangent to Cylinders and Cones	86
Points in which Surfaces are pierced by Lines	94
Intersection of Cylinders and Cones. Developments	96
Convolutes, and Problems relating to Them	120
Warped Surfaces with a Plane Directer	125
The Hyperbolic Paraboloid	128
Planes Tangent to Warped Surfaces with a Plane Directer	132
The Helicoid	138
Warped Surfaces with Three Linear Directrices	142
Surfaces of Revolution	146
The Hyperboloid of Revolution of One Nappe	147
Double-Curved Surfaces of Revolution	156
Planes Tangent to Surfaces of Revolution	158
Intersection of Surfaces of Revolution with Other Surfaces	163
Problems relating to Trihedral Angles. Graphical Solution of Spherical Triangles	169

PART II

SPHERICAL PROJECTIONS

PAGE

Preliminary Definitions 179
Orthographic Projections of the Sphere 182
Stereographic Projections of the Sphere 189
Globular Projections 201
Gnomonic Projection 203
Cylindrical Projection 203
Conic Projection 203
Construction of Maps 205
Lorgna's Map 206
Mercator's Chart 207
Flamstead's Method 208
The Polyconic Method 210

PART III

SHADES AND SHADOWS

Preliminary Definitions 212
Shadows of Points and Lines 215
Construction of an Ellipse on its Conjugate Diameters . . . 219
Practical Problems 220
Brilliant Points 231

PART IV

LINEAR PERSPECTIVE

Preliminary Definitions and Principles 238
Perspectives of Points and Straight Lines. Vanishing Points of Straight Lines 239
Perspectives of Curves 243
Vanishing Points of Rays of Light and of Projections of Rays . 247
Perspectives of the Shadows of Points and Straight Lines on Planes . 248
Practical Problems 250

PART V

ISOMETRIC DRAWING

Preliminary Definitions and Principles 278
Isometric Representation of Points and Lines 280
Practical Problems 281

PART I

ORTHOGRAPHIC PROJECTIONS

Preliminary Definitions

1. Geometry enables us to determine unknown magnitudes, relationships, and forms from those which are known. There are in general two methods of solution for any given problem; namely, the *analytical* and the *graphical*. In the former we arrive at our results by calculation; in the latter we make drawings which represent graphically the true relationships between the points, lines, and surfaces under consideration, and arrive at our results without calculation.

2. Graphics. If the problem relates to points and lines lying in only one plane, the graphical solution may be reached by a simple application of the principles of Geometrical Drawing, or *Plane Graphics*.

If the problem relates to magnitudes not in the same plane, the graphical solution would require an application of the principles of Descriptive Geometry, or the *Graphics of Space*.

3. Descriptive Geometry is that branch of Mathematics which has for its object the explanation of the methods of representing by drawings:

First. All geometrical magnitudes.

Second. The solution of problems relating to these magnitudes in space.

These drawings are so made as to present to the eye, situated at a particular point, the same appearance as the magnitude or object itself, were it placed in the proper position.