

**ELEMENTS OF
DESCRIPTIVE GEOMETRY,
WITH ITS APPLICATION TO
SPHERICAL PROJECTIONS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649496303

Elements of Descriptive Geometry, with Its Application to Spherical Projections by Albert E. Church

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

ALBERT E. CHURCH

**ELEMENTS OF
DESCRIPTIVE GEOMETRY,
WITH ITS APPLICATION TO
SPHERICAL PROJECTIONS**

ELEMENTS
OF
DESCRIPTIVE GEOMETRY,

WITH ITS APPLICATION TO
SPHERICAL PROJECTIONS.

BY
ALBERT E. CHURCH, LL. D.,
PROFESSOR OF MATHEMATICS IN THE U. S. MILITARY ACADEMY; AUTHOR OF
ELEMENTS OF THE DIFFERENTIAL AND INTEGRAL CALCULUS;
AND OF ELEMENTS OF ANALYTICAL GEOMETRY.



^C
NEW YORK:
PUBLISHED BY BARNES & BURR,
51, 53 & 55 JOHN STREET.
1865.

PREFACE.

THESE pages have been written and are published with the single object of presenting, in proper form to be used as a text-book, the course of Descriptive Geometry, as taught at the U. S. Military Academy.

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.

Though indebted for many of the ideas to the early instructions of his predecessor and friend, Professor Davies, whose text-books on this subject were among the first in the English language, the author has been much aided by a frequent reference to the French works of Leroy and Olivier, and to the elaborate American work of Professor Warren.

It is intended to include, in an edition to be issued at an early day, the application of the subject to shades and shadows, and perspective.

U. S. MILITARY ACADEMY, }
October, 1864 }

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in the context of public administration and financial management. The text highlights that records should be kept in a secure, accessible, and organized manner to facilitate audits and ensure compliance with relevant laws and regulations.

2. The second part of the document outlines the various methods and tools used for record-keeping. It mentions traditional paper-based systems as well as modern digital solutions, such as cloud storage and database management systems. The text notes that digital systems offer advantages like ease of access, searchability, and reduced risk of physical damage or loss. However, it also points out the need for robust security measures to protect sensitive information stored electronically.

3. The third part of the document addresses the challenges associated with record-keeping. It identifies issues such as data redundancy, inconsistent formatting, and the potential for human error in data entry. The text suggests that implementing standardized procedures and training for staff can help mitigate these challenges. Additionally, it mentions the importance of regular data backups and disaster recovery plans to ensure the integrity and availability of records in the event of a system failure or natural disaster.

4. The fourth part of the document discusses the legal and regulatory requirements for record-keeping. It references various international and national standards, such as ISO 15489, which provides a framework for records management. The text emphasizes that organizations must be aware of their specific legal obligations and ensure that their record-keeping practices align with these requirements to avoid penalties and legal consequences.

5. The fifth part of the document explores the role of records in decision-making and organizational performance. It argues that well-maintained records provide valuable insights into trends, patterns, and areas for improvement. By analyzing historical data, organizations can make more informed decisions, optimize their operations, and enhance their overall performance. The text also notes that records are crucial for legal defense and dispute resolution, providing a clear and verifiable trail of events.

6. The sixth part of the document discusses the importance of record retention and disposal. It explains that records should be kept for a specific period, determined by legal and organizational requirements. The text emphasizes that records should be disposed of securely and in a timely manner to prevent unnecessary clutter and reduce the risk of information leakage. It also mentions the importance of documenting retention and disposal schedules to ensure compliance with relevant regulations.

7. The seventh part of the document discusses the role of records in crisis management and disaster recovery. It highlights that records are essential for understanding the causes and impacts of a crisis, as well as for developing effective recovery plans. The text notes that having up-to-date and accurate records can significantly reduce the time and resources required to restore operations after a disaster. It also mentions that records are crucial for communicating with stakeholders and providing transparency during the recovery process.

8. The eighth part of the document discusses the role of records in research and innovation. It argues that records provide a wealth of data that can be analyzed to identify new opportunities and trends. The text notes that records are essential for tracking the progress of research projects, documenting findings, and sharing knowledge with other researchers. It also mentions that records are crucial for protecting intellectual property and ensuring the integrity of research results.

9. The ninth part of the document discusses the role of records in public participation and transparency. It highlights that records are essential for providing citizens with access to government information and decision-making processes. The text notes that having open and accessible records can help build trust in government and promote accountability. It also mentions that records are crucial for monitoring and evaluating public programs and services, and for identifying areas for improvement.

10. The tenth part of the document discusses the role of records in environmental management and sustainability. It highlights that records are essential for tracking and reporting on environmental performance, such as greenhouse gas emissions and resource consumption. The text notes that having accurate records can help organizations identify areas for improvement and develop effective strategies to reduce their environmental impact. It also mentions that records are crucial for complying with environmental regulations and reporting requirements.

CONTENTS.

PART I.

ORTHOGRAPHIC PROJECTION.

	PAGE
Preliminary definitions.....	1
Representation of points.....	2
Representation of planes.....	4
Representation of right lines.....	5
Revolution of objects.....	7
Revolution of the vertical plane.....	8
Notation used in the description of drawings.....	12
Manner of delineating the different lines used.....	12
Elementary problems relating to the right line and plane.....	13
Construction and classification of lines.....	33
Projection of curves.....	36
Tangents and normals to lines.....	37
Generation and properties of the helix.....	39
Generation and classification of surfaces.....	40
Generation and properties of cylindrical surfaces.....	43
Generation and properties of conical surfaces.....	44
Warped surfaces with a plane director.....	47
Generation and properties of the hyperbolic paraboloid.....	49
Warped surfaces with three linear directrices.....	51
Generation and properties of the helicoid.....	53
Surfaces of revolution.....	54
The hyperboloid of revolution of one nappe.....	56
Tangent planes and surfaces; normal lines and planes.....	61
Problems relating to tangent planes to single curved surfaces.....	66
Problems relating to tangent planes to warped surfaces.....	74
Problems relating to tangent planes to double curved surfaces.....	78
Points in which surfaces are pierced by lines.....	83
Intersection of surfaces by planes. Development of single curved surfaces.....	86

Intersection of curved surfaces.....	99
Development of an oblique cone.....	104
Practical problems.....	107

PART II.

SPHERICAL PROJECTIONS.

Preliminary definitions.....	113
Orthographic projections of the sphere.....	116
Stereographic projections of the sphere.....	121
Globular projections.....	130
Gnomonic projection.....	131
Cylindrical projection.....	132
Conic projection.....	132
Construction of maps.....	134
Lorgna's map.....	135
Mercator's chart.....	135
Flamstead's method.....	137
The Polyconic method.....	138

PART I.

ORTHOGRAPHIC PROJECTIONS.

PRELIMINARY DEFINITIONS.

1. **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.

The representations thus made are *the projections of the magnitude or object.*

The planes upon which these projections are usually made are *the planes of projection.*

The point, at which the eye is situated, is *the point of sight.*

2. When the point of sight is in a perpendicular, drawn to the plane of projection, through any point of the drawing, and at an infinite distance from this plane, *the projections are Orthographic.*

When the point of sight is within a finite distance of the drawing, *the projections are Scenographic*, commonly called *the Perspective* of the magnitude or object.

3. It is manifest that, *if a straight line be drawn through a given point and the point of sight, the point, in which this line pierces the plane of projection, will present to the eye the same appearance as the point itself, and therefore be the projection of the point on this plane.*

The line thus drawn is *the projecting line of the point.*

4. In the *Orthographic Projection*, since the point of sight is at an infinite distance, the projecting lines drawn from any points of an object, of finite magnitude, to this point, *will be parallel to each other and perpendicular to the plane of projection.*

In this projection two planes are used, at right angles to each other, the one *horizontal* and the other *vertical*, called respectively *the horizontal and vertical plane of projection.*

5. In Fig. 1, let the planes represented by ABF' and BAD be the two planes of projection, the first *the horizontal* and the second *the vertical.*

Their line of intersection AB is *the ground line.*

These planes form by their intersection four diedral angles. The *first angle*, in which the point of sight is always situated, is above the horizontal and in front of the vertical plane. *The second* is above the horizontal and behind the vertical. *The third* is below the horizontal and behind the vertical. *The fourth*, below the horizontal and in front of the vertical, as marked in the figure.

REPRESENTATION OF POINTS.

6. Let M , Fig. 1, be any point in space. Through it draw