PLANE GEOMETRY: SUGGESTIVE METHOD; PP. 1-214

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649672325

Plane Geometry: Suggestive Method; pp. 1-214 by George C. Shutts

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

GEORGE C. SHUTTS

PLANE GEOMETRY: SUGGESTIVE METHOD; PP. 1-214

Trieste

Plane
Geometry

Plane
Geometry
Suggestive Method

By
George C. Shutts
Instructor in Mathematics, State Normal School
Whitewater, Wisconsin

Atkinson, Mentzer & Grover
Chicago Publishers Boston

THE PREFACE.

THIS present book is a revision of the Van Velzer and Shutts Plane and Solid Geometry, Suggestive Method, published by Tracy, Gibbs & Company. The method of the book was used by the author for several years from mimeograph reprints. This text was then revised and incorporated into text-book form. After being again thoroughly tested in many of the best schools in the country, the work has been again revised in an attempt to make it more suggestive to the teacher and more helpful to the student.

In putting the work into its present form the scientific classification of the subject-matter has been departed from when it was thought that by so doing the work could be better graded to the ability of the average pupil. For this reason the subject of the triangle has been introduced before the relation of lines and angles has been fully discussed.

The treatment of the theory of measurement has been modified to make it more easily understood. A treatment of the application of proportion has been suggested that will make the pupil more independent in his work, and at the same time it has not increased the difficulty of the subject.

The book, as now arranged, is sufficient for all college entrance requirements, yet it can be completed, including all the exercises, by high-school pupils in one school year. For those schools that devote a year and a half to the subject additional work has been placed in the Appendix, to which references are given in the text, so that the various propositions and exercises can be taken up in logical order. A fuller treatment of the theory of limits, which many teachers desire, is also given in the Appendix.

A departure from ordinary methods will be noticed in the treatment of proportion. It has not been thought wise to follow the usual method of limiting the subject to proportions whose terms are pure numbers, nor yet to follow the Euclidian method common in England, which admits of proportions whose terms are concrete magnitudes, but which is so difficult that it can be understood by only the best students. The method in the text will be found to admit of proportions whose terms are concrete magnitudes, yet it will do no violence to the fundamental ideas of Arithmetic regarding operations upon concrete magnitudes. It is believed that the subject of limits is treated in so simple a manner that beginners can grasp it.

An edition, consisting of the theorems, the diagrams, the things given, and the things to prove, *without* suggestions for demonstration, will accompany the book for class-room use. It is hoped that this will be found as valuable in Geometry teaching as "text editions" have been in teaching the classics. This "Class-Room Edition" will save the time of the recitation usually consumed by the pupils in drawing the figures upon the blackboard. The complete edition of the book can be banished from the recitation and the temptation to get assistance from the text eliminated. The blackboards can thus be reserved for original demonstrations of exercises and for suggestive work by the teacher. The Class-Room Edition will lengthen the daily recitation, and make it possible for more work to be done in a year.

The author wishes to thank those who have given the previous edition of the book so kind a reception. It is hoped that the present book will more fully meet the needs of all teachers who wish their pupils to make the largest possible growth in independent thinking in Geometry.

Acknowledgment should be made of the scholarly criticism of Dr. C. A. Van Velzer, *Head of the Department of Mathematics in the University of Wisconsin*, for his helpful services in preparing for publication the manuscript of the first edition of the book.

Thanks are also due for valuable suggestions in reading the proof to Mr. G. E. Bunsa, *Superintendent of Schools, Columbus, Wisconsin;* Mr. R. L. Sandwick, *Principal of the Deerfield Township High School, Highland Park, Illinois;* Miss Genevieve Decker, *Teacher of Mathematics in the High School, Janesville, Wisconsin;* Miss Maud Averill, *Teacher of Mathematics in the High School, Whitewater, Wisconsin,* and to Mr. Frank P. Dodge, *Instructor in Mathematics in the Roxbury Latin School, Roxbury, Massachusetts.*

G. C. S.

Whitewater Wis., August 25, 1904.

SUGGESTIONS TO TEACHERS.

GEOMETRY is essentially a disciplinary study. The value derived from its study is in proportion to the amount of independent thought expended by the pupil. A text-book in Geometry is in the nature of a "key" to the extent to which the demonstrations are written out for the pupil. That part of the work which a pupil can do for himself should not be done for him. The teacher and text-book should furnish the pupil with data and stimulate thought rather than give him a set form of words which he may repeat verbatim, with or without, the ideas which these words should express.

In this Geometry suggestions arranged in logical order take the place of detailed demonstration. These suggestions are intended to stimulate and direct the thought of the pupil so that he may largely work out his own demonstrations.

Model demonstrations are given of a few propositions to show the student the *form* in which they should be presented. The answers to the suggestions, logically arranged, constitute the demonstration. The suggestions should be studied in the order given, for each suggestion usually depends upon the preceding one. The answer to a suggestion should consist of a statement of the relations asked for, together with the authority in full for such statement.

To permit the pupil to ignore the authority is to encourage carelessness, slovenliness, and inaccuracy in demonstration. A common error is to apply authority that does not exactly fit the conditions under consideration. The pupil must understand that the authority should, without exception, be a definition, an axiom, or a previously proved proposition. "It seems so," or, "it looks reasonable," or any expression of judgment will not do. The pupil should be encouraged to search out his own authority, even when the authority is quoted for him in the suggestions, and to use the reference simply for verification. A pride in independent work is a most important factor in securing satisfactory results.

In the preparation of the lesson the pupil should write out his demonstration, noting carefully the form of the "models." This will insure correct form and avoid haziness of thought. During the first few weeks this written work, as well as tests taken in the recitation, should be read by the teacher and returned to the pupil for correction.

The exercises, or at least a part of them, should be demonstrated daily along with the propositions as they occur, and not be studied all together at the end of a chapter.

The best results will be obtained by starting slowly, reviewing frequently, and passing over nothing that is not clearly understood. Since each demonstration involves previous propositions and definitions, facility in demonstration can best be secured by committing to memory each theorem, definition and axiom; for that authority cannot be readily recognized and applied which is imperfectly remembered. The demonstrations should not be committed to memory.

The subject of proportion is probably the most difficult part of Geometry. Clearness of thought in the applications of proportion can be obtained only by careful illustration and rigid demonstration in the theory. To teach the theory of proportion by means of numbers, and then to apply the principles developed to geometric magnitudes and numbers indiscriminately without consideration of limitations of the various statements, is not scientific. Note 262, page 137, should receive careful attention. In deriving the form $A = m\,B$ from $\frac{A}{B} = m$ the tendency is to claim the multiplication of both members of the equation by B. This is correct if B is a number, but the process is unthinkable if B is a geometric magnitude. $\frac{A}{B}$ means that A is divided or measured by the unit B, hence to say that A contains B, m times, is simply another way of saying that A is m times the unit B, or m B. 12 contains 4 three times ($\frac{12}{4} = 3$) is another form of expression for 12 is equal to 3 fours ($12 = 3 \times 4$). The expression $\frac{1 \text{ foot}}{1 \text{ inch}} = 12$, means the same as the expression 1 foot is equal to 12 inches. In this connection see § 270.

PLANE GEOMETRY.

CHAPTER I.

RECTILINEAR FIGURES.

Definitions.

1. The block represented in the accompanying figure occupies a limited portion of space. If we imagine the block to be removed, its form or shape can still be retained in the mind. This is true of any object or body.

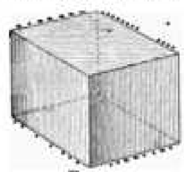

FIG. 1.

The space conceived to be occupied by an object or body as distinguished from the substance of which it is made, is a **geometrical solid.** The matter or substance of which a body or object is composed is a physical solid. Hence a geometrical solid is the shape or form of a physical solid, or some form or figure conceived by the mind.

A **geometrical solid** is a limited portion of space, and has length, breadth, and thickness.

The term solid will be used hereafter to signify a geometrical solid.

2. When space is divided into distinct portions or geometrical solids, the boundaries of these portions or solids are **surfaces.** Distinct portions of the bounding surface are **faces.**

Surface has length and breadth, but no thickness.