CONCRETE GEOMETRY. INTRODUCTORY TO FORMAL PLANE GEOMETRY

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CONCRETE GEOMETRY

INTRODUCTORY

TO

FORMAL PLANE GEOMETRY

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TO THE TEACHER.

This book has been prepared primarily for class-room work only, although it may be used equally well for outside work also. The best results will be obtained by having each pupil provided with a blank book with flexible cover so that it may be opened out flat after the manner of a copy book, the pages being of a size sufficient to accommodate a figure at the top and, below this, the answers to questions referring to the figure. The work in this blank book should be divided into sections numbered to correspond with those in the text-book. The answer to every question should be written in the form of a complete statement. By the use of such a book the work of each pupil is easily preserved, and back work can be referred to at any time. The blank book will also be found useful for the purpose of reviewing. It is obvious that accuracy and neatness are essential.

It is intended that the majority of the definitions and geometric principles be deduced by the pupils themselves. Spaces have been left for the purpose of writing these definitions and statements in their proper places in the body of the text as well as in the blank book; but they should not be written in the text-book until the class, as a whole, under the guidance of the teacher, has learned to express them in a satisfactory manner. The purpose of this book is to teach geometric facts and how to use them; but, although we have endeavored to make the deduction of these facts as obvious as possible, it is not intended, in the majority of cases, to hold the pupil responsible for the deduction. That belongs more properly to the study of Formal Geometry. At the end of the book will be found

model examination papers on each chapter. These are designed to suggest to the teacher, who may be more familiar with the requirements of Formal Geometry, how far and in what way he should expect the pupil to be familiar with the geometric properties of plane figures, with the abstract statement of those principles, and with the logical methods used occasionally for establishing the truth of a general statement.

It is evident that, in order to obtain satisfactory results, the teacher should have a thorough knowledge of Demonstrative Geometry, and be familiar with the wording of its definitions and theorems. He should repeatedly call the attention of students to the fact that the deductions in this book from particular concrete examples are not demonstrations; but that in common life we attach to such conclusions a high degree of probability.

Where it is undesirable to have the text-book marked by the pupil, the definitions and statements may be written in the blank book only, and marked with the proper section number to admit of easy reference.

LIST OF TOOLS.

In order to make the constructions and measurements required, each pupil should be provided with the following tools:

Ruler, twelve inches long.

Compasses, five and one half inches.

Scale, twelve inches long, with one edge divided into sixteenths of an inch and the other into centimeters and millimeters.

Protractor. The best form of protractor for this purpose is one of horn or celluloid, divided into degrees numbered both ways, and not more than four inches in diameter.

45° triangle, five-inch edge.

30°×60° triangle, five-inch edge.

Lead pencil.

Eraser.

Scissors.

The teacher should have a scale, one meter long, divided into decimeters and centimeters on one side and into inches and eighths of an inch on the other, two large triangles, and a large paper protractor for blackboard work and for making explanations to the class. It is also necessary to have two wooden cylinders, with diameters of 7 cm. and 1 dm., respectively. (See § 157.)

Tools may be ordered with the books, if desired.

CONTENTS.

CHAPTER I.

STRAIGHT LINES AND ANGLES.

1. We are all more or less familiar with the meaning of the word *surface*. We know what is meant by the surface of the earth, the surface of a pond, the surface of a table, etc.

It is clear that a surface has no *thickness*, but is merely the outside or boundary of any solid object.

In *elementary geometry* we deal with only a few well defined surfaces, such as the surface of a sphere, called a *spherical surface;* the surface of a cylinder, called a *cylindrical surface;* the surface of a cone, called a *conical surface*, and the plane surface called a *plane*.

The surface of a ball or soap bubble is an illustration of a spherical surface.

The surface of a lead pencil or gas pipe is an illustration of a cylindrical surface.

The surface of a funnel is an illustration of a conical surface.

(The different surfaces should be illustrated to the class by models.)

We shall deal with only one of these surfaces, namely, the **plane.**

Of the many illustrations of a plane we may take the surface of a small pond, which is a plane surface when it lies perfectly smooth and undisturbed by wind or other force.

The intersections of two surfaces or the boundaries of a surface are **lines.**