THE CHILD'S PRACTICAL GEOMETRY; BEING A SERIES OF ELEMENTARY PROBLEMS IN DRAWING PLANE GEOMETRICAL FIGURES, AS GIVEN IN THE COURSE OF LESSONS IN PUBLIC SCHOOLS

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The Child's Practical Geometry; Being a Series of Elementary Problems in Drawing Plane Geometrical Figures, as Given in the Course of Lessons in Public Schools by Walter Smith

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WALTER SMITH

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PRACTICAL GEOMETRY;

BEING

A Series of Elementary Problems

IN DRAWING

PLANE GEOMETRICAL FIGURES,

AS GIVEN IN THE COURSE OF LESSONS IN PUBLIC SCHOOLS.

COMPILED AND ADAPTED BY

WALTER SMITH,

STATE DIRECTOR OF ART EDUCATION, MASSACHUSETTS.

Special Edition for the Use of Schools, and intended as a Text-Book in Grammar and High Schools.

BOSTON:

JAMES R. OSGOOD AND COMPANY,

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1872.

ANNOUNCEMENT.

MESSRS. JAMES R. OSGOOD & CO. have the pleasure of announcing that they have arranged with MR. WALTER SMITH, Professor of Art Education in the Boston Normal School of Art, and State Director of Art Education, Massachusetts, for the publication of his series of text-books on Drawing.

This series will be the most complete and comprehensive one ever published in America, and will be adapted to schools of all grades.

The Drawing-Books will be prepared on an entirely new and original plan, and will embrace a thorough explanation and illustration of the principles of

Free-Hand Drawing,

Model and Object Drawing,

Perspective, Geometrical, and Mechanical Drawing.

Copies of the work on Free-Hand Drawing will be published shortly.

JAMES R. OSGOOD & CO., Publishers,

124 TREMONT STREET, BOSTON.

PREFACE.

ALTHOUGH existing books on Geometrical Drawing are numerous, and some of them excellent, yet in a wide experience I have found no book quite adapted to the requirements of students in schools of art, still less suitable as a class-book for use in schools for general education.

My object in compiling this work has been to supply a deficiency felt, I believe, generally by art-masters who have an extensive field for instruction. Several years of experience in teaching classes, both in schools of art and in other schools, as well as in superintending the teaching of drawing in primary and adult schools, have enabled me to try experiments in systematizing the arrangement of geometrical problems, and to obtain conclusions based on the results of such experiments. The experience thus obtained has been embodied in this work.

In the "*School of Art Practical Geometry*," I have endeavored to produce an elementary text-book, which should contain problems for the construction of such geometrical figures as are of most frequent use to the designer or artisan: the knowledge of at least all the problems contained in it will be a necessary preliminary to the study of Perspective, Mechanical Drawing, and Architectural Drawing. Repetition of methods for arriving at the same result has been as much as possible avoided, and the simplest method, if practically accurate, has been adopted, even where other methods more mathematically accurate could have been used, when counterbalanced with the evil of puzzling and complicated working.

The importance of a knowledge of Geometrical Drawing at the commencement of a study of drawing is paramount; and, though many persons learn to draw well without a knowledge of it, yet I have never known a case where a student did not progress more satisfactorily in his studies after a course of practical geometry. I have also been led to believe that such an elementary course of geometrical drawing as I have compiled would be of use in schools as a preparation for the study of Euclid. The care required in drawing the figures with accuracy, and the explanations given at the blackboard demonstrations, will be found to lead to a correct knowledge of geometric forms; and it seems only rational that upon the successful practice of constructing such forms might be built a habit of thinking and reasoning accurately about their nature.

The present part comprises only the elementary problems of a work to be shortly issued, containing a wider range of study, and greater variety of problems.

DIRECTIONS TO THE PUPIL.

BEFORE commencing the *Problems*, it will be necessary that the *Definitions* be committed to memory, and the figures illustrating them drawn with tolerable accuracy.

A problem in geometrical drawing is naturally divided into three parts, which, avoiding mathematical expressions, may be called, 1st, the conditions; 2d, the working; 3d, the result. Thus, for example, in Prob. No. 10, which is "*to draw a line parallel to a given line* AB *at the distance* CD *from it*," the first part, or *conditions*, being the lines AB and CD; the second part, or *working*, being the arcs described; the third part, or *result*, being the line EF.

To distinguish these separate features is very necessary for a clear understanding of a problem; and, to facilitate this, I have used three distinct kinds of lines in the illustrations:—

The first, or *conditions*, being the *thin* lines, _____

The second, or *working lines*, being *dotted* lines, ...

The third, or *result lines*, being *thick* lines, _____

So that, with a single glance at the illustration, the pupil may see, 1st, *what* had to be done; 2d, *how* it has been done; 3d, the figure when done.

When working from the blackboard, the pupil need make no difference between the conditional lines and the working lines; but the result lines should be made darker than the others. But in working the problems in his lesson-book afterwards (which should always be done as soon as possible after the lesson), the lines of the problem should either be distinguished by the three lines as used in the illustrations,—*i.e.*, thin, thick, and dotted lines; or, what is still better, the conditions should be in *blue* color, the working in *red*, the result in *black*. For red and blue, use crimson lake and Prussian blue colors, not red and blue ink, which change color after use.

It will be seen, by referring to the illustrations, that I have used both letters and numerals in the description: this is also to help to make the problems more intelligible. The letters are used for points in the *conditions* and *results*, the numerals in the *working*. When points in the working will form part of the description of the result, then letters are used; but when it is necessary to use points in the working, which form no part of the result, then numerals are used. The numerals may also assist in showing how the work is done, by indicating the steps taken: thus, point 1 will be the first point in the working, either assumed or obtained; point 2 will be a consequence of the use of point 1; the point 3 will result from the use of 2; and so on.

In arranging the problems, I find it better to put them in pairs which either treat of the same figure, or have a similar result. Thus, by referring to the sheet of problems commencing 31, it will be seen that 31 is to make an equilateral triangle *on a given base*; 32, *in a given circle*; 33, to make a square *on a given base*; 34, *in a given circle*; and the same principle of arrangement may be observed throughout all the first part of the book, and is as much as possible adhered to in the latter part also.

The Index of the Problems and Definitions is to be used as a test of the student's power of remembering what he has learnt. After working out all the problems from the book, he should again work them out from the index, without referring to the text or illustrations. The questions on the definitions should be answered by sketches, and by writing them from memory.

DEFINITIONS.

LINES AND ANGLES.

Def. 1. A *point* A, is a term used to express a position.

EXAMPLE. — The lines 1 2 and 3 4 cross or intersect each other in point A.

LINES.

A Line is usually described by two letters, as AB; or two figures, such as 1 2, as in the last example.

Def. 2. A *right* or *straight* line AB, is the shortest line that can be drawn between two points, A and B.

Def. 3. A *curved* line AB, is one which is otherwise than straight.

Def. 4. *Parallel* lines AB and CD, are those which are everywhere equally distant from each other; and which, therefore, if continued, can never meet.

ANGLES.

Def. 5. An *angle* BAC is formed when two straight lines, BA and CA, meet at the same point A.

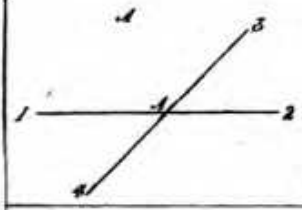
Def. 6. There are three kinds of angles. 1. Right angles; 2. Obtuse angles; 3. Acute angles.

Def. 7. A *right angle* is formed thus: when one straight line AB, standing on another straight line CD, makes the two angles ABC and ABD equal to each other, each angle is said to be a right angle. When two lines form right angles, each line is said to be perpendicular to the other.

Def. 8. An *obtuse* angle ABC is that which is greater than a right angle, DBC.

Def. 9. An *acute* angle ABC is that which is less than a right angle, DBC.

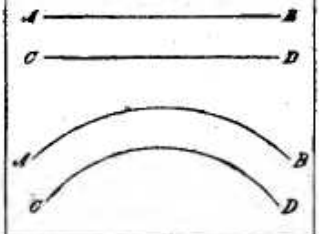
DEF. 1.



DEF. 2.

DEF. 3.

DEF. 4.



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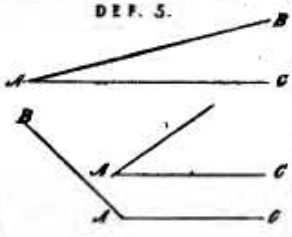

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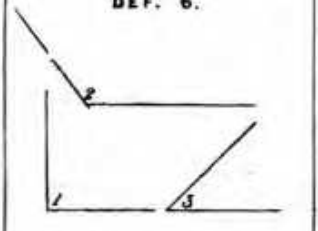
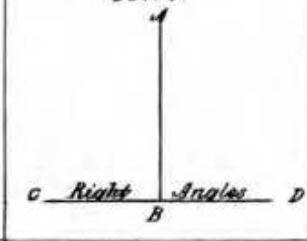


DEF. 7



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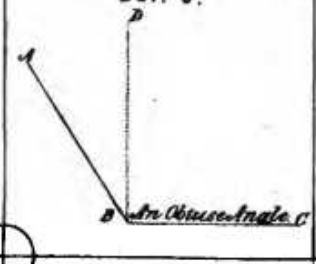

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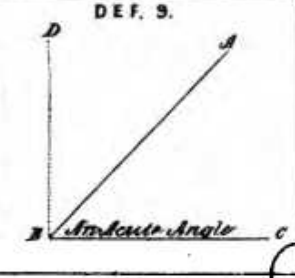

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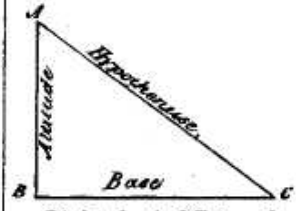
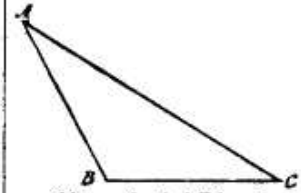


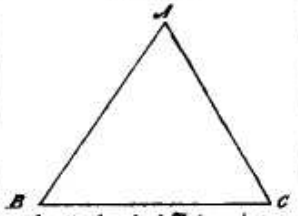
Right Angled Triangle

DEF. 12.



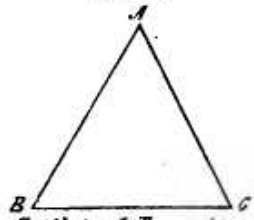
Obtuse Angled Triangle

DEF. 13.



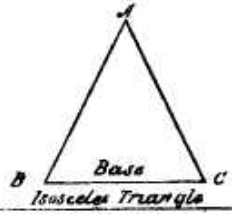
Acute Angled Triangle

DEF. 14.



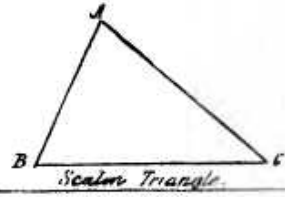
Equilateral Triangle

DEF. 15.



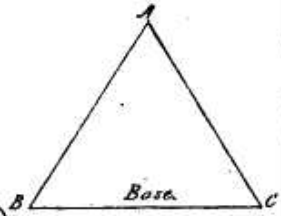
Isosceles Triangle

DEF. 16.



Scalon Triangle.

DEF. 17



DEF. 18.