AN ELEMENTARY TREATISE ON GEOMETRICAL DRAWING

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An Elementary Treatise on Geometrical Drawing by J. H. Robson

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AN ELEMENTARY TREATISE ON GEOMETRICAL DRAWING

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AN ELEMENTARY TREATISE

ON

GEOMETRICAL DRAWING,

WITH NUMEROUS EXAMPLES,

Chiefly Selected from Army Examination Papers.

BY THE

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PREFACE.

THIS Manual is intended primarily for the use of Students who are preparing for the Preliminary Examination for entrance to the Royal Military Academy at Woolwich, or to the Royal Military College at Sandhurst. In either case Geometrical Drawing is one of the compulsory subjects.

But, apart from this special object, the Author's experience in tuition has convinced him that the subject deserves a place in the curriculum of studies in any good school. Exact drawing greatly facilitates the conception of geometrical methods, and frequently arouses, in the mind of a young student, an interest which merely scientific reasoning from rough diagrams fails to awaken.

Edgeborough, Guildford,
September 1st, 1880.

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GEOMETRICAL DRAWING.

SCALES.

ABBREVIATIONS.—The double accent (″) denotes inches; ABC denotes the *angle* ABC; △ ABC denotes the triangle ABC.

1. **Diagonal scales** are used to measure distances too minute to be otherwise found.

In Fig. i. we have a diagonal scale to read *inches*, *tenths of an inch*, and *hundredths of an inch*, or, as it is generally expressed, "inches to two places of decimals."

In this figure, the distance AB, for example, = 3.64″.

$$\begin{aligned} \text{For DB} &= 3'' \\ \text{AC} &= \tfrac{6}{10}'' \\ \text{and CD} &= \tfrac{4}{100}'' \end{aligned}$$

The general rule for taking off such distances is this. Measure from the intersection of the *vertical* 3 and the *horizontal* 4, to the point where this horizontal line is cut by the *diagonal through* 6.

B

Before proceeding further the student is recommended to draw lines, say 3.27", 5.63", 3.09", 5.8", 3.46".

They should be taken off the *half-inch diagonal scale* given on the Protractor. These distances being *doubled* will be the lengths required.

2. *General method of constructing* **any** *diagonal scale, to read, say, A, B, C.*

(i.) Draw as many equidistant horizontal lines as will make the same number of spaces as there are C in B.

(ii.) Mark off vertical divisions each of which shall represent A.

(iii.) Subdivide (at the top) the first vertical division into as many equal parts as there are B in A.

(iv.) Draw the parallel diagonals.

Thus suppose A, B, C, to be **yards, feet,** and **inches,** and the scale to be one inch to the yard.

(i.) We make 12 equal spaces; (because there are 12" in 1 foot.)

(ii.) We draw verticals one inch apart; (because a yard is to be represented on the scale by 1".)

(iii.) We subdivide the first division into 3 equal parts; (because there are 3 ft. in one yard.)

(iv.) We draw the parallel diagonals.

This scale is drawn in Fig. ii.

To take off any length, say 4 yds. 2 ft. 7 in. from the scale, we must measure from the intersection of the vertical

4, and the horizontal 7, to the point where this horizontal line is cut by the diagonal through 2. (AB, in Fig. ii.)

3. All these lines, horizontal, vertical, and diagonal, may be drawn by the Marquois Scales. By moving the index on the triangle successively over the same number of graduations on the scale, we can rule lines which are not only parallel, but *equidistant* also. Further, this distance may be *specified*. Say that our parallels are required to be $\frac{1}{10}$'th of an inch apart. We take the 50 scale and move the index over 5 graduations at a time. If the parallels are required to be $\frac{1}{12}$'th of an inch apart, we take the 60 scale and move the index over 5 graduations at a time. This method depends on the fact that by moving the index through 50 *graduations of the* 50 *scale*, 60 *graduations of the* 60 *scale*, and so on, we rule 2 lines which are parallel and *one inch apart*.

4. When every line in a drawing is some *constant* fraction of what it represents, the drawing is said to be "to scale," and the constant fraction is called the **Representative Fraction.**

Thus, if every line in the drawing is an 84th part of the corresponding line in the object represented, we say that

the scale is 84 inches to the inch,

i.e., 7ft. to the inch;

or that the Representative Fraction is $\frac{1}{84}$.

The Representative Fraction is therefore

$$\frac{\text{Any line in the drawing in inches}}{\text{What that line represents in inches}}.$$

5. Two other examples of diagonal scales are given, which the student should examine carefully.

(i.) *Make a diagonal scale to read miles and furlongs on a scale of 20 miles to the inch. Show 100 miles. Take off 37m. 5f. State the Representative Fraction.*

In this case the A, B, C of section 2 are

groups of 10 miles, 1 mile, 1 furlong.

$$\text{Now, as } \overset{\text{m.}}{20} : \overset{\text{m.}}{100} : 1'' : x''$$

$$\therefore \quad 20\,x = 100 \quad \therefore \quad x = 5''$$

We therefore make 8 horizontal spaces by drawing parallel lines 5 inches long. We draw the verticals half an inch apart (to show 10 miles), and subdivide the first division into 10 equal parts (Fig. iii.).

AB in the figure obviously represents 37 m. 5 f.

$$\left.\begin{matrix}\text{The Representative}\\ \text{Fraction}\end{matrix}\right\} = \frac{1}{20 \times 1760 \times 36} = \frac{1}{1267200}$$

Notice.—In this scale, 20 miles being represented by 1 inch, 1 mile is represented by $\frac{1}{20}''$. The subdivision of that $\frac{1}{20}''$ into 8 equal parts, for furlongs, would be difficult in consequence of the parts being so extremely minute. But the diagonal scale avoids the difficulty without sacrificing anything.

(ii.) *Make a diagonal scale to read miles, furlongs, and chains, if 3 miles are shown by $3\frac{1}{4}''$. Assume 7 miles. Take off 3 m. 7 f. 6 ch., and state the Representative Fraction.*

Since 3 miles are shown by $3\frac{1}{4}''$, 1 mile is shown by $1\frac{1}{12}''$. Ten chains make a furlong. Therefore we must make 10 horizontal spaces, the verticals must be $1\frac{1}{12}''$ apart, and the first division must be subdivided into 8 equal parts.

AB in the figure (iv.) represents 3 m. 7 f. 6 ch.

$$\text{The Representative Fraction} = \frac{3\frac{1}{4}}{3 \times 1760 \times 36}$$

$$= \frac{13}{12 \times 1760 \times 36}$$

$$= \frac{13}{760320}$$

Note.—The verticals may be drawn $1\frac{1}{12}''$ apart by using the 60 scale and moving the index of the triangle over 65 *graduations.*