Seventh Meeting, May 13th, 1887.

George Thom, Esq., LL.D., President, in the Chair.

Some Correspondence between Robert Simson, Professor of Mathematics in the University of Glasgow, and Matthew Stewart, Professor of Mathematics in the University of Edinburgh.

By James Taylor, M.A.

This correspondence, purchased at the sale of the Gibson-Craig collection of MSS., is now in the possession of Dr J. S. Mackay.

An Experiment in the Teaching of Geometry.

By A. Y. Fraser, M.A., F.R.S.E.

§ 1. The course of geometry here referred to was given to pupils in George Heriot's School in the session preceding that in which they should begin the usual systematic study of geometry. The chief object of the course was to furnish their minds with a number of geometrical ideas before they should meet with these ideas as treated by Euclid. Subsidiary ends were also kept in view—such as to get them to make neat and accurate figures, and to enable them to solve various practical problems of construction and measurement.

§ 2. The classes with whom the experiment was tried were three in number, containing each fifty boys. The average age of the boys at the middle of the session was 12·3, 13·2 and 13 years. The time given was one period of forty-five minutes per week.

§ 3. The school provided fifty pairs of compasses and fifty box-wood rulers ($9\frac{1}{2}''$ long, of special design, $\frac{1}{4}''$ at each end being unmarked and the inches being divided into 8ths, 10ths, 12ths, and 16ths). Each pupil had a note-book about the size of an ordinary copy book, ruled in squares $\frac{1}{3}'' \times \frac{1}{3}''$.

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§ 4. The method adopted in the lessons was in the main as follows:—First the problem was worked out on the blackboard, an attempt, which was usually successful, being always made to get the pupils to discover the solution for themselves. After the ground was cleared in this way, the pupils wrote down in their books a simple statement of the construction or measurement to be effected, and this they carried out in the manner that had been finally adopted on the blackboard. A further study of the figure would bring out interesting facts, which also were noted by the pupils in their books.

To encourage accuracy, and also to make supervision of work easily possible, every construction done by the pupils was reduced sooner or later to measurement, the results obtained were given out by the pupils in answer to their names, and were noted down, and then the pupils were told what the result should have been had all their work been exact. The pupils were seated in alphabetical order, so that miraculous coincidences of results could be readily detected and investigated. With a view to the work to be done by the pupils in future sessions in the physics laboratory, they were made to enter the results of their measurements in neat tabular forms.

§ 5. Before giving any details of the propositions discussed, I wish to say that I did not attempt to draw up a systematic course beforehand; I simply made up my mind about a few groups of notions that I thought I could introduce, and the amount of time I gave to any one set of ideas was determined by the amount of useful interest I could arouse in those ideas. Whenever I found the interest likely to wane, I prepared for the introduction of a fresh discussion; the group of notions dropped being, if necessary, resumed and extended later on by way of revisal.

§ 6. I shall now give pretty full notes of two of the groups of ideas discussed (the construction and measurement of a triangle, and Euclid I. 32, with consequences) by way of specimen, and then brief notes of the rest of the work done in the twenty-five lessons gone through up to the date of the reading of this paper.

§ 7. Notes of Lessons.

Lesson 1. *Make a* △ *with sides* 2″, 2½″, 3″ *long* (3 *measurements.*)

(i) *having* 2″ *side as base.*

(ii) ,, 2½″ ,,

(iii) ,, 3″ ,,

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Number of measurements required to determine any rectilineal figure investigated and tabulated as follows :—

No. of Sides	3 4 5 6......n
No. of Measts.	3 5 7 9......$2n-3$

Discussion on way to find area of Δ.

Area of rectangle.

Area of Δ shown to be $=\frac{1}{2}$ circumscribing rectangle.

Rule deduced for finding Δ area, and noted.

Necessary for above to be able to draw a ⊥ from a point on a line.

Two methods given.

Lesson 2. *Draw* ⊥*rs from the vertices of the* Δ*s in lesson* 1, *and hence find the areas of the three* Δ*s.*

Enter results in tabular form as shown on the blackboard.

Lesson 3. *Make a quadrilateral ABCD having given* $AB=5''$, $BC=3''$, $CD=3\frac{1}{2}''$, $DA=5\frac{1}{2}''$, $AC=6''$ (5 *measurements*).

Find its area by finding the area of each Δ.

How to find the area of any rectilineal figure.

. . . .

Lesson 8. Show how to make an ∠ on one part of the page equal to an ∠ on another part, then give the following exercise:

Make a Δ*ABC of any size and shape, and at* ∠ *A copy down* ∠*s equal to B and C. Let these be BAD and DAE.*

Produce CA to any point F.

Take a show of hands as to the coincidence or non-coincidence of AF with AE.

All but a very few will declare for coincidence or very near coincidence.

Note result (Euc. I., 32).

Note how to draw a line parallel to another.

Lesson 9. An equilateral Δ is equiangular.

Hence ∠ of equilateral $\Delta=\frac{1}{3}$ of $180°=60°$.

How to make ∠*s* of 60°, 30°, 15°, &c. (How to bisect an ∠ has already been shown.)

Make an ∠ *of* 60° *and one of* 30° *beside it.*

Show that this is just the method (already given without explanation) of drawing a ⊥ at end of line.

§ 8. The other chief points taken up were :

a. The construction of triangles and quadrilaterals from various data (the angles given being always 90°, 45°, 60°, 30°, and the like).

b Illustrations of Euc. I., 47.

c Discussion of figures of the same shape (their areas, &c.).

The principles of mapping and drawing to scale.

How to measure the breadth of a river without crossing it.

d Use of squared paper to find areas. A Δ described and its area found (1) by counting the whole squares included and estimating the broken ones; (2) by the ordinary method. Results compared. Area of circle found in this way.

§ 9. To the foregoing I am permitted now (March 1888) to add a few remarks.

The course above described is neither complete nor systematic. If an idea came in the regular course, good and well; if a digression was necessary we digressed. We had no text-book to follow, and no examination to prepare for. As it happened, the pupils were examined after all, and it may encourage others to know that the work was characterised as "an excellent special course."

This session the course, still subject to modification, is being repeated to four classes similar to last year's three. A problem discussed this year with great interest was the finding of the distance of an inaccessible object by actual work in the open air. The pupils got out in batches of ten (the rest of the class working at another problem). A chain was used to measure the base line, and the base angles were taken by the eye applied to a ruler laid along the paper. Precautions were taken to have the books in the proper position. Further work of this kind is to be done.

Eighth Meeting, June 10*th*, 1887.

GEORGE THOM, Esq., LL.D., President, in the Chair.

Note on Milner's Lamp.

By Professor TAIT.

This curious device is figured at p. 149 of De Morgan's *Budget of Paradoxes*, where it is described as a "hollow semi-cylinder, *but not with a circular curve*," revolving on pivots. The form of the cylinder is