THE

MATHEMATICAL GAZETTE.

EDITED BY

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WITH THE CO-OPERATION OF

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COMMITTEE ON THE TEACHING OF ELEMENTARY MATHEMATICS.

A meeting of the above Committee of the Mathematical Association was held at King's College, London, on Saturday, Oct. 3rd, the President, Prof. A. R. Forsyth, F.R.S., being in the chair.

Messrs. C. S. Jackson (Royal Military College, Woolwich) and L. S. Milward (Malvern College) were elected members of the Committee.

It was decided to send a letter to the Head Masters of Public Schools asking how far they would recognise and insert questions in Practical and Theoretical Geometry in their Entrance Examinations and Scholarship Entrance Examinations, in accordance with the syllabus recommended by the Cambridge Syndicate, which was adopted by Grace of the Senate on June 11th, 1903. The object of seeking this information is to afford guidance to Preparatory Schools in the teaching of Geometry.

A Sub-Committee was formed to consider and report on the teaching of Elementary Mechanics. Five members were elected, with power to add to their numbers, viz.: Prof. G. M. Minchin, and Messrs. F. W. Hill, C. S. Jackson, A. W. Siddons, and C. O. Tuckey. Communications in reference to the work of this Sub-Committee should be addressed for the present to C. O. Tuckey, Esq., M.A., Charterhouse School, Godalming.

M. A. COMMITTEE.

THE following letter has been addressed to all the schools mentioned in the *Public Schools Yearbook.*

TRINITY COLLEGE, CAMBRIDGE,
October 19th, 1903.

Dear Sir,—The Committee of the Mathematical Association has been approached by the Association of Headmasters of Preparatory Schools as to the advisability of at once beginning to teach Geometry in Preparatory Schools on the lines laid down in the new regulations for the Cambridge Previous Examination.

It may be pointed out that these regulations come into full force after 1905 (during 1904 and 1905 examinations will be held under both new and old regulations); and the new regulations at Oxford come into force in the autumn of 1904. That being so, all boys at present at Preparatory Schools who proceed to the Universities must of necessity be examined there under the new regulations.

In these circumstances, many Preparatory School Masters feel that they ought to take steps to introduce the new methods at once; but they are not confident that, if they do so, they may not place some of their pupils at a disadvantage for a short time in the immediate future.

In order that these School Masters may be in a position to act upon fuller knowledge, I shall be much obliged if you will be kind enough to answer the questions below, and to communicate your answers to the Honorary Secretary of the Committee, A. W. Siddons, Esq., Harrow-on-the-Hill.

If you have printed regulations for your entrance, and entrance scholarship examinations, I should be glad if at the same time you would kindly send Mr. Siddons a copy, in order that the Committee may be able to refer to them from time to time.—I am, Yours faithfully,

A. R. FORSYTH, *President, Math. Assoc.*

P.S.—A copy of this letter is being sent to your Senior Mathematical Master.

Name of School..

1. Will questions on experimental and practical geometry be set in your entrance and entrance scholarship examination?

2. Will the freedom of proof and method set out in the new University regulations be allowed in these examinations?

3. Will boys, after admission to your School, be restricted to Euclid in method and matter?

Replies have been received from the following schools:

Abingdon, Aldenham, Bath, Bedford, Berkhamsted, K.E.S. Birmingham, Blundell's (Tiverton), Birkenhead, Bradfield, Bradford, Bromsgrove, Cambridge (Leys and Perse Schools), Canterbury (King's School and St. Edmund's), Carlisle, Charterhouse, Cheltenham (College and Dean Close School), Chester, Chigwell, City of London, Clifton, Merchant Taylors' Crosby, Derby, Dover, Dulwich, Durham, Eastbourne, Epsom, Eton, Exeter, Felsted, Giggleswick, Glenalmond, Guernsey, Haileybury, Harrow, Hereford, Highgate, Hull, Ipswich, King William's College, Isle of Man, Jersey, King's College School, Lancing, Leeds, Liverpool College, Malvern, Manchester, Marlborough, Stroud, Merchant Taylors, Merchiston Castle, Mill Hill, Monmouth, Newcastle, Norwich, Oakham, Oundle, Oxford (St. Edward's), Plymouth, Pocklington, Portsmouth, South Eastern College, Ramsgate, Reading, Repton, Rossall, Rugby, St. Bees, St. Olave's, Sedbergh, Sherborne, Shrewsbury, Stonyhurst, Sutton Valence, Tonbridge, Trent College, University College School, Uppingham, Wakefield, Warwick, Wellington, Westminster, Winchester, Worcester.

Seventeen schools have not yet replied.

To question 1, the reply was in each case in the affirmative except as follows: Clifton, Derby and Durham answered "probably"; St. Olave's "possibly"; Oakham "will set questions on practical but not on experimental ; Merchiston and Liverpool do not include Geometry in these examinations.

To question 2, the reply was "yes" in every case except that of Cheltenham College. They say "Freedom of proof and method allowed if it does not violate the logical sequence of Euclid."

To question 3, the replies were all in the negative, though at one school Euclid is still retained as a textbook, and a selection of propositions is made.

Berkhamsted, instead of answering the separate questions, said that Euclid was entirely abandoned.

The replies show how very real a reform is being made; every school seems to encourage practical work, and, except in one case, to grant the freedom which the Universities have considered it wise to give. The report of the Committee has played no small part in obtaining these reforms; and though, at the time of publishing the report, it seemed politic not to advocate quite so much freedom, the Committee warmly welcomes the additional freedom granted by the Universities.

A. W. SIDDONS, *Hon. Sec. Math. Assoc. Committee.*

TO REACH THE CALCULUS AS EARLY AS POSSIBLE.

IN these days the student of applied science finds that he can make little progress till he has acquired a knowledge of the Calculus. If he cannot acquire this knowledge sufficiently soon in the mathematical class-room, his science teacher will have to do the work which ought to fall to the duty of the mathematician, and will at the same time be thereby debarred from devoting the time to other teaching which he would like to give.

There are many things in mathematics—*e.g.*, that much over-rated landmark in the construction of syllabuses, the Binomial Theorem*—which are of much less use to such a student than a mere knowledge of the notation of the Calculus. The following remarks are put forward as suggestions of how the Calculus might be commenced at an earlier stage in the study of algebra and trigonometry than has hitherto been the practice. They may at least serve as a basis for further discussion.

I. *Algebraic Forms.*

(1) As soon as a beginner has learnt a very little about multiplication and division in algebra, he may be taught the *proper* way (not the way he usually uses) to divide $(x^2-3x+2)-(a^2-3a+2)$ by $x-a$. By putting x for a in the quotient the differential coefficient of x^2-3x+2 is obtained, and in this way the student may learn to find the differential coefficients of simple algebraic forms.

(2) The differential coefficient of a positive integral power can be found as soon as the beginner has learnt to divide x^n-a^n by $x-a$. When this has been done, easy instructive exercises may be given in writing down the differential coefficients of such expressions as $x^5-16x^4+5x^3+2x^2+x-1$, and the expressions of which these are the differential coefficients, even without previously having wasted time in multiplying or dividing such expressions, or in finding their greatest common measure or least common multiple.

Greatest common measure in algebra has always seemed to me a useless piece of drudgery. The sums take a long time to work out and often come wrong, and I have so far failed to discover any case in which the method is actually made use of, except in connection with Sturm's Theorem on the roots of a quantic equation.

(3) The differential coefficient of $1/x^n$ is equally easy to obtain, and may be discussed in connection with the meaning of negative integral indices. The interpretation of these may easily be arrived at by continuing backwards the processes which give rise to the series x, x^2, x^3, x^4, etc.

(4) The differential calculus may be used with advantage to determine the coefficients in the expansion of $(a+x)^n$, and thus to prove the Binomial Theorem for a positive integral index. The method will be identical with that employed in the ordinary determination of the coefficients in Maclaurin's Theorem. This proof is at any rate as short and simple as, and

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* The Binomial Theorem is merely the formula for shifting the origin in the graph of $y=x^n$.