and they were closely followed by large audiences at the last morning and afternoon sessions of the Section. The reports of Professors Brown and Webster were presented before a joint session of Sections A and B, the former being read by Professor R. S. Woodward (who was at the same time invited to present his own papers 14, 15, 16 to the joint session). Some of the reports will be printed in the BULLETIN and some in the *Proceedings*. Nos. 17, 18, 35, 36, 37 are also in the nature of reports of progress. The Council of the Association has now passed a resolution encouraging all the sectional committees to procure reports of this nature from competent scientists.

The Council elected to fellowship in the Association the following mathematicians and astronomers: Professor R. D. Bohannan, Mr. J. F. Hayford, Professor H. C. Lord, Dr. G. A. Miller, Miss Mary Proctor.

The next meeting of the Association will be held at Columbus, August, 1899, under the presidency of Professor Edward Orton. The officers elected for Section A are Dr. Alexander Macfarlane, Lehigh University, and Mr. J. F. Hayford, Coast and Geodetic Survey.

JAMES MCMAHON.

CORNELL UNIVERSITY.

NOTES.

THE fourth regular meeting of the Chicago Section of the AMERICAN MATHEMATICAL SOCIETY will be held in room 35 of the Ryerson Physical Laboratory, University of Chicago, on Thursday and Friday, December 29th and 30th next. Titles, abstracts, and time requirements of papers to be presented should be in the hands of the secretary of the Section, Professor Thomas Holgate, Evanston, for the use of the programme committee, not later than December 10th.

AT the Bristol meeting of the British Association for the Advancement of Science, DR. MICHAEL FOSTER was elected president, PROFESSOR G. H. DARWIN one of the vice-presidents, and MAJOR P. A. MACMAHON a member of the Council. Grants of money to the extent of about seventy five hundred dollars were appropriated to purposes of scientific research, the section of mathematics receiving one-third of the amount. The following papers were presented before

the mathematical section :—By Lord KELVIN: "Graphic representation of the two simplest cases of a single wave."—By Professor EDGEWORTH: "The mathematical representation of statistics."—By Professor J. G. STOKES: "The imaginary of logic."—By Dr. JOHNSTONE STONEY: "The dynamical explanation of certain observed phenomena of meteor streams."—By Dr. JOHNSTONE STONEY: "A survey of that part of the scale upon which nature works, about which man has some information."—By Mr. J. H. VINCENT: "On the use of logarithmic co-ordinates."—By Professor HELE-SHAW: "A new method of describing cycloidal and other curves."—By Mr. E. T. WHITTAKER: "The recent history of the theory of the functions used in analysis."—By Colonel ALLAN CUNNINGHAM:—Report of the committee appointed for calculating certain mathematical functions, announcing the completion of the manuscript of a set of tables giving the residues of the powers of 2 for all prime moduli less than 1000. At future annual meetings of the mathematical section it is proposed to have presented a number of reviews of recent progress in various branches of pure mathematics.

THE Royal Scientific Society of Göttingen proposes as its prize problem for the year 1901: To develop the law of reciprocity of the lth power residues for an arbitrary numerical body, l being an odd prime number. The statement of the problem is accompanied by the following explanation: Let l be an odd prime number, ζ one of the lth roots of unity other than 1, and k an arbitrary algebraic numerical body which contains the number ζ. If then ν, μ are any two integers of the body k, and w any prime ideal in k, the most general law of reciprocity for the lth power residues in the numerical body k is represented by the equation

$$\prod_{(w)} \left\{ \frac{\nu, \mu}{w} \right\} = 1.$$

In this formula the product extends over all prime ideals w of the body k, and the symbol $\left\{ \frac{\nu, \mu}{w} \right\}$ designates an lth root of unity to be suitably defined and unequivocally determined by the numbers ν, μ and the prime ideal w.* This law of reciprocity is to be worked out completely; it is also to be demonstrated, at least for certain remarkable special cases

*See D. Hilbert, Theorie der algebraischen Zahlkörper, part 5, chapters 28–36, *Berichte der Deutschen Mathematiker-Vereinigung*, 1897.

or under appropriate simplifying assumptions. Particular value will be attached to the construction of numerical examples which appear capable of explaining and confirming the given law of reciprocity. The prize is one thousand marks. Manuscripts conforming to the usual regulations of such competitions will be received until February 1st, 1901.

HARVARD UNIVERSITY. The courses which were to have been given by Professor J. M. PEIRCE during the current academic year will be omitted as Professor Peirce has just been granted a year's leave of absence. In order to fill in part the gap thus made in the scheme of mathematical courses Professor F. S. WOODS of the Massachusetts Institute of Technology has been appointed lecturer in mathematics for the year 1898–99 to give a course in higher geometry which is to consist of three lectures a week throughout the year.

DURING the winter semester 1898–99, the several universities mentioned below offer the following mathematical courses:

UNIVERSITY OF KÖNIGSBERG. By Professor VOLKMANN: Electromagnetic theory of light, four hours; Seminar in mathematical physics, one hour.—By Professor STRUVE: Theory of satellites, two hours.—By Professor HÖLDER: Partial differential equations, two hours; Theory of numbers, four hours; Seminar, one hour.—By Professor MEYER: Critical pedagogical study of elementary mathematics, one hour; Integral calculus, three hours; Application of the integral calculus to geometry, one hour; Introduction to the mathematical theory of potential, two hours; Exercis s in mathematical seminar, one hour.—By Professor SAALSCHÜTZ: Higher differential coefficients and reversion of series, one hour; The barycentric calculus of Möbius, one hour; Exercises in algebraic analysis, one hour; Determinants and other branches of algebraic analysis, four hours. —By Dr. RATHS: Spherical astronomy, three hours.—By Dr. COHN: Method of least squares, two hours; Theory of astronomical instruments, two hours.—By Dr. VAHLEN: Analytical geometry of space, four hours.

UNIVERSITY OF LEIPZIG. Professor SCHEIBNER will lecture, but the subjects of his courses are unannounced.—By Professor NEUMANN: Selected chapters of analytical mechanics, four hours; Mathematical seminar, one hour.—By Professor BRUNS: Celestial mechanics, four hours; Theory of probability, two hours; Seminar for scientific computing, two hours.

—By Professor MAYER: Introduction to analytical mechanics, calculus of variations, one hour.—By Professor ENGEL: Infinitesimal calculus, four hours; Theory of analytical functions, two hours; Seminar, one hour.—By Dr. HAUSDORFF: Projective geometry, four hours; Political arithmetic three hours.

UNIVERSITY OF MUNICH. By Professor BAUER: Theory of equations; Surfaces of the third order; Mathematical seminar.—By Professor LINDEMANN: Theory of functions of a complex variable; Application of the infinitesimal calculus to the theory of curves and surfaces; The problem of the quadrature of the circle; Mathematical seminar.—By Professor SEELIGER: Theory of potential and the figure of the heavenly bodies; Astronomical colloquium.—By Professor PRINGSHEIM: Differential calculus; Exercises on the former; Theory of numbers.—By Professor GRAETZ: Analytical mechanics; Exercises in mechanics.—By Dr. DONLE: Introduction to the electro-magnetic theory of light.—By Dr. BRUNN: Exercises connected with the reading of mathematical classics.—By Dr. DÖHLEMANN: Descriptive geometry, with exercises; Graphical statics, with exercises.—By Dr v. WEBER: Introduction to analysis; Ordinary differential equations.

UNIVERSITY OF STRASSBURG. By Professor REYE: Geometry of position, three hours; Analytical mechanics, two hours.—By Professor BECKER: Selected chapters of celestial mechanics, two hours.—By Professor WEBER: Theory of elliptic functions, four hours; Theory of algebraic numbers, two hours; Advanced seminar, in conjunction with Dr. Wellstein, one hour; Lower sem nar, one hour.—By Professor ROTH: Algebraic analysis and determinants, three hours; Analytical geometry of space, two hours; Ordinary differential equations, two hours.—By Professor KRAZER: Infinitesimal calculus, four hours; Analytical geometry of the plane, three hours; Exercises in the infinitesimal calculus, two hours —By Dr. WELLSTEIN: Invariant theory of binary forms.

WE learn from a recent number of *Nature* that DR. G. VAILATI, writing in the *Bolletino di Storia e Bibliografia Matematica*, has brought to light an obsolete book of Euclid dealing with balances and the principle of the lever. Euclid's reasoning seems to have been based on two axioms: 1° that if a loaded lamina balances about a horizontal axis, it will continue to balance when the weights are displaced parallel to the axis; 2° if a lamina balances horizontally about two

intersecting axes in its plane, it will also balance about their point of intersection; he arrives at the conditions of equilibrium of a lever whose arms are in the ratio of two whole numbers by a method closely analogous to that adopted by Archimedes. The work has become known through an Arabic translation by Ibn Musa in the National Library at Paris, an account of which was given in 1851 by Woepke in the *Journal Asiatique*, but seems to have been overlooked by mathematicians.

THE papers and proceedings of the first International Congress of Mathematicians held at Zürich, August 9–11, 1897, have just been issued in one volume by Teubner under the editorship of PROFESSOR FERDINAND RUDIO. From the press of the same publisher has recently appeared the first part of the first volume of the "Encyclopädie der mathematischen Wissenschaften mit Einschluss ihrer Anwendungen" (see BULLETIN, 2d Series, vol. 3, p. 356, vol. 4, p. 32) projected by the academies of science of Göttingen, Munich, and Vienna under the immediate editorship of PROFESSORS H. BURKHARDT, of Zürich, and W. F. MEYER, of Königsberg.

THE works of LAGUERRE are being published under the auspices of the Paris Academy of Sciences and the editorial supervision of PROFESSORS HERMITE, POINCARÉ, and ROUCHÉ, in an edition of two volumes to be occupied respectively with analysis and geometry; Gauthier-Villars announces that the first volume is ready. Of the publications of the same firm, the fourth and concluding volume of TANNERY and MOLK'S "Éléments de la théorie des fonctions elliptiques" is in type, and the fourth and last part of MÉRAY'S "Leçons nouvelles sur l'analyse infinitésimale et ses applications" has just been received from the press. The former of these two volumes is devoted to the integral calculus and applications, the latter to the classic geometrical applications of the infinitesimal calculus.

THE MACMILLAN COMPANY announces the appearance of an "Introduction to the theory of analytic functions," by PROFESSORS JAMES HARKNESS, of Bryn Mawr College, and FRANK MORLEY, of Haverford College; the first volume of a "Treatise on infinitesimal analysis," by PROFESSOR W. B. SMITH, of Tulane University; a "Text-book on the calculus," by PROFESSOR P. A. LAMBERT, of Lehigh University; and a "Treatise on graphics," by PROFESSOR F. N. WILLSON, of Princeton University.

PROFESSOR F. MORLEY has resumed the chair of mathematics at Haverford College after a year abroad on leave of absence.

ASSISTANT PROFESSOR S. I. BAILEY has been promoted to an associate professorship of astronomy at Harvard University.

DR. E. P. CHILDS has been appointed professor of physics in the University of New Mexico.

MR. J. M. POOR has been appointed instructor in astronomy in Dartmouth College.

PROFESSOR W. C. TINDALL, until recently head professor of the department of mathematics in the Missouri State University, died on September 17th.

THE University of Pennsylvania has given its alumnæ mathematical fellowship for women to MISS R. H. VIVIAN.

FATHER CYPRIEN, of the monastery of Mount Athos, formerly the well-known explorer, Prince C. Wiasemsky, contributes to the *Revue générale des Sciences* for the 15th of September, 1898, an article entitled: "New theory of transcribed spheres."

PROFESSOR H. POINCARÉ, of the University of Paris, contributes an article "On the foundations of geometry" to the October number of the *Monist*.

NEW PUBLICATIONS.

I. HIGHER MATHEMATICS.

ADAM (C.). See DESCARTES.

ALLEN (J.). See TANNER (J. H.).

BREUER (A.). Elementar entwickelte Theorie und Praxis der Functionen einer complexen Variabelen in organischer Verbindung mit der Geometrie. Vienna, Daberkow, 1898. 8vo. 8 and 205 pp.

DESCARTES. Oeuvres de Descartes. Publiées par Charles Adam et Paul Tannery, sous les auspices du ministère de l'instruction publique. Correspondance, II (mars 1638-décembre 1639). Paris, Cerf, 1898. 4to. 23 and 657 pp.

FATTOR (L.). Di una construzione delle coniche per punti e per tangenti. Cividale, Fulvio, 1898. 8vo. 7 pp.

GIUDICE (F.). Nozioni sulle transformazioni puntuali e sui gruppi continui. Brescia, Appolonio, 1898. 8vo. 10 and 144 pp.

GOETTLER (J.). Conforme Abbildung eines von confocalen elliptischen und hyperbolischen Kurven *n*ter Ordnung begrenzten Flächenstückes auf der Halbebene. (Programme.) Passau, Waldbauer, 1898. 8vo. 34 pp. M. 1.00