teaching, programmes and requirements, philosophical and pedagogical questions, etc.

The contents of the first number indicate the way in which it is proposed to accomplish this object. After an introductory article by the editors, explaining the general scope of the new publication, we find articles on mathematics in Spain, by Professor Galdeano; on mathematical terminology, by M. Laisant; on scientific pedagogy, by Professor A. Binet, director of the psychological laboratory at the Sorbonne; on the teaching of "mathématiques spéciales" in France, by M. H. Laurent; on the teaching of elementary trigonometry, by Professor H. Fehr; on the teaching of the theory of vectors, by Professor Fontené. Besides these original papers there are sub-divisions devoted to notes and news, to correspondence, to bibliography and reviews. Among the latter, the review by Professor Greenhill of Professor Appell's "Éléments d'analyse mathématique(cours de l'École centrale)" may be particularly noted.

The editors call for coöperation on all persons interested in the teaching of mathematics throughout the civilized world and promise to attend, if necessary, to the translation into French of contributions written in other languages. It is to be hoped that this appeal will meet with a hearty response. Mathematical teaching is hardly anywhere organized as thoroughly and efficiently as in France; indeed, there is perhaps somewhat too much of organization and system. Just the opposite would seem to be true for most of the States of the Union; comparing notes on these questions may not be without advantage on both sides.

ALEXANDER ZIWET.

NOTES.

ATTENTION is called to a recent change in the By-Laws of the AMERICAN MATHEMATICAL SOCIETY, permitting members to commute their annual dues by a single payment of $50. Until May 1, 1899, the treasurer will accept such payment from intending life members who have already paid the dues for 1898. New members joining the Society and desiring to begin as life members, are required to make a single payment of $55 to cover the initiation and life membership fees.

THE fifth regular meeting of the Chicago Section of the AMERICAN MATHEMATICAL SOCIETY will be held at Northwestern University, Evanston, Illinois, on Saturday, April 1, 1899. Titles and abstracts of papers to be presented should be sent to Professor T. F. Holgate, secretary of the Section, for the use of the Programme Committee not later than March 11th.

THE Association of German Scientists and Physicians will meet next September in Munich. Over two thousand members were present at the meeting at Düsseldorf in 1898.

THE London Mathematical Society held a regular meeting on the 8th of December, 1898, at which Major P. A. MACMAHON communicated a discovery which he had made in the theory of compound partitions; Mr. J. E. CAMPBELL read a paper "On simultaneous partial differential equations; Lieut. Col. A. J. C. CUNNINGHAM presented some notes on three very high primes. The following papers were communicated in abstract: "On hyper-plane coördinates," by Mr. W. H. YOUNG; "Two problems of wave propagation at the surface of an elastic solid" and "The influence of gravity on waves in an elastic solid, with special reference to the Earth," by Mr. T. J. BROMWICH: "On a theorem in determinants allied to Laplace's," by Mr. W. H. METZLER. Among the new members elected at this meeting is Professor F. MORLEY, of Haverford College.

THE three concluding volumes of the "Encyclopædia of the mathematical sciences," edited by H. BURKHARDT and W. FR. MEYER (see BULLETIN, 2d series, vol. 3, p. 326, vol. 4, p. 32, vol. 5, p. 109, pp. 151, 202) will be made up in the following manner:

Volumes IV and V:—*A*. Applications of Mathematics to Mechanics and Technical-Mechanical Problems. 1. Fundamental Principles; 2. Kinematics; 3. Kinematics of machines; 4. Statics; 5. Dynamics of a material point, including the theory of Jacobi and Hamilton; 6. Dynamics of rigid bodies and connected systems; 6*a*. Ballistics; 7. Elasticity; 8. Rigidity, plasticity, pressure; 9. Technical statics; 10. Technical dynamics; 11. Hydrodynamics; 12. Hydraulics; 13. Capillarity, cohesion.—*B*. Applications to Physics and Physical-Technical Problems. 1. Thermodynamics; 2. Conduction of heat; 3. Heat engines; 4. Kinetic theory of matter; 5. Molecular structure, crystallography, symmetry of the physical differential equations; 6. Electrostatics, magnetostatics, steady galvanic

currents; 7. Electrodynamics, electric and electromagnetic induction; 8. General theory of electromagnetism; 9. Electrotechnics; 10. Electromagnetic theory of light; 11. Optical waves; 12. Optical rays, optical instruments; 13. Emission, absorption, photometry.—*C.* Applications to Astronomy and Geodesy:—1. Spherical astronomy, (*a*) Coördinates and transformation of coördinates, (*b*) Corrections on account of precession, nutation, parallax, aberration, and refraction, (*c*) Determination of geographical position, navigation; 2. Geodesy; 3. Theoretical astronomy, determination of an orbit from observations; 4. Physical astronomy, calculation of perturbations, (*a*) Classical methods, (*b*) Recent attempts at reform. Volume VI:—*A.* History, Philosophy, Didactics.—*B.* A Review of the Development of the Mathematical Sciences in the Nineteenth Century.—*C.* Index.

RECENT advices from the Vatican state that the Abbé COZZA LUZZI, assistant librarian, has found Galileo's original manuscript treatise on the tides. The manuscript is in Galileo's handwriting and concludes with the words:—"Written in Rome in the Medici Gardens on January 8, 1616." The currently accepted text, the original of which was supposed to have been lost, differs considerably from that of the manuscript just found. Pope Leo XIII has taken the greatest interest in the discovery and has ordered the manuscript to be published in an elegant edition at the expense of the Vatican.

AMONG the papers presented at the last annual meeting of the Astronomische Gesellschaft, held at Budapest, is one by Professor R. VON KÖVESLIGETHY, of the University of Budapest, entitled "Ueber die beiden Parametergleichungen der Spectral Analyse," the object of which is to develop a mathematical theory for astrophysics. The author shows how the two fundamental equations of heat are destined to play as important a rôle in astrophysics as the principles of mechanics in astronomy. To this end the equation of emission is formed very simply in terms of the wave length and of two parameters which depend on the nature of the bodies. The author finds that his theory represents perfectly a series of bolometric measurements of the spectrum; he further insists that his analysis is applicable to important questions in astronomy, such as the determination of parallaxes, and the volume and density of the heavenly bodies.

THE Prussian Academy of Sciences has undertaken the publication of the mathematical correspondence of Leibnitz

under the editorship of Professor C. J. GERHARDT. The correspondence is to be reproduced in three royal octavo volumes, of which the first, consisting of seven hundred and sixty-eight pages, has just appeared from the press of Mayer and Müller, of Berlin. The first volume contains Leibnitz's correspondence with Oldenburg, Newton, Collins, Conti, Tschirnhaus, and Huygens; the editor of the work regards the material of this volume as sufficient to establish the claims of Leibnitz to the priority in the discovery of the infinitesimal calculus. Following the publication of his method and its use by the continental mathematicians, Leibnitz's correspondence in reply to requests for explanations and further exposition was voluminous and extensive; the correspondence of this period, which contains many unpublished discoveries of Leibnitz, will be incorporated in the second and third volumes, which may be expected to be rich in facts relative to the history of mathematics in the second half of the seventeenth and the first half of the eighteenth century.

A MANUSCRIPT treatise on geometry by Lobatschewsky of earlier date than any of his published works has recently been found at Kasan. Its publication will be undertaken by the Physico-Mathematical Society of Kasan.

THE press of Harper and Brothers announces the publication of the first number of Harper's Scientific Memoirs, a series of handbooks in science, under the general editorship of Dr. JOSEPH S. AMES, professor of physics in Johns Hopkins University. The series will embrace a large number of translations and reprints of the most important articles which have been written in the history of science, including many which have an important bearing upon the present state of science. It is proposed to print these papers with accompanying figures in thin octavo volumes, which shall be convenient for reference and yet inexpensive. The volumes will be printed in the English language, special attention being given to the translation or reproduction. Notes, explanations, and corrections will be added where needed, and references will be given from time to time to contemporary or later work. A bibliography and index will close each volume. The associate editors of the series for subjects in mathematics, mechanics, and thermodynamics are Professors W. F. MAGIE, of Princeton University, C. BARUS, of Brown University, T. C. MENDENHALL, of Worcester Polytechnic Institute, and A. G. WEBSTER, of Clark University.

AN ENGLISH translation of the second Italian edition of Loria's "Il passato ed il presente delle principali teorie geometriche," with a preface by the author, will soon be published by Professor GEORGE BRUCE HALSTED, of the University of Texas.

THE mathematical publications of the firm of Leach, Shewell, and Sanborn, have been transferred to the publishing house of D. C. Heath and Company.

PROFESSOR E. MOUGIN, of the lycée de Laval, has issued a second edition of his "Nouvelles tables de logarithmes à cinq décimales," with the imprint of the press of the author and the date 1899. These tables contain: 1° the logarithms of the numbers from 1 to 10,000, with differences and proportional parts, in nine pages (1,111 logarithms on a page whose size is $6\frac{1}{2}$ by $7\frac{1}{2}$ inches), so arranged that the initial significant figure of the number indicates the page on which the logarithm is to be found, *e. g.*, 6,725, page 6; 2° in eighteen pages the logarithmic sines, cosines, tangents, and cotangents for every minute of the first quadrant; 3° explanatory notes accompanied by numerous illustrative examples; 4° the elementary formulæ of mathematics and physics on a sheet attached by a thread so that the sheet may be removed at the time of examination and replaced later. The economy of space exhibited by the ingenious construction of these tables is further shown by the fact that while the classic tables employ more than ninety thousand figures to express the logarithms of numbers to five places of decimals, Mougin uses fewer than thirty thousand.

AT the recent anniversary meeting of the Royal Society of London the Copley Medal was awarded to Sir WILLIAM HUGGINS for his great achievements in the application of spectrum analysis to the heavenly bodies; the Rumford Medal was given to Professor OLIVER J. LODGE in recognition of his researches on radiation and on the relations between ether and matter; one of the Royal Medals was bestowed upon the Reverend JOHN KERR as the author of extremely important experimental researches in the optical relations of electricity and magnetism; and the Darwin Medal was received by Professor KARL PEARSON in recognition of the great biological importance of his work upon the theory of probability and its relation to vital statistics.

THE Paris Academy of Sciences, at its annual meeting held on December 19, 1898, awarded its prizes for the year 1898, among which are the following: the Grand Prize of

the mathematical sciences to M. ÉMILE BOREL for his memoir on the rôle of divergent series in analysis, M. MAURICE SERVANT being awarded an honorable mention. The Bordin Prize was not awarded ; the Francœur Prize was given to M. VASCHY, and the Poncelet Prize to M. J. HADAMARD. The Extraordinary Prize in mechanics of six thousand francs was divided among MM. BAULE, G. CHARPY, THIÉBAUT, L. RAVIER, and MOISSENET ; the Montyon Prize was awarded to M. DE MAS, a Fourneyron Prize to M. C. BOURLET, another being divided between MM. E. CARVALLO and JACOB, and a very honorable mention to M. SHARP. The Lalande Prize in astronomy was given to Dr. S. C. CHANDLER, for his researches on the variation of latitude and on variable stars, M. CHOFARDET receiving an encouragement ; the Damoiseau Prize was awarded to Dr. G. W. HILL for his numerous memoirs in mathematics and astronomy ; the Valz Prize was given to M. P. COLIN, and the Janssen Prize to M. BELOPOLSKY.

The prizes offered by the Academy for the next two years include the following in mathematical subjects : To be awarded at the annual meeting in December, 1899 :—The Bordin Prize for the most successful memoir on the questions relative to the determination, with regard to properties and applications, of systems of orthogonal curvilinear coördinates in n variables, including as precise as possible an indication of the generality of these systems ; the Francœur Prize for works and discoveries useful to the progress of pure and applied mathematics ; the Poncelet Prize for the most useful work to the progress of pure or applied mathematics ; the Extraordinary Prize of six thousand francs for progress of a nature to increase the efficiency of the French naval forces ; the Montyon Prize in mechanics ; the Plumey Prize for the best contribution to the progress of steam navigation ; the Lalande and Damoiseau Prizes in astronomy, and the Montyon Prize in statistics. To be awarded at the annual meeting in December, 1900 :—the Grand Prize of the mathematical sciences for the memoir perfecting, in some important point, the investigation of the number of classes of quadratic forms, having integral coefficients, in two indeterminates ; the Bordin Prize for developing and perfecting the theory of surfaces applicable on the paraboloid of revolution ; the Damoiseau Prize for working out the theory of one of the periodic comets of which several returns have been observed. All works and manuscripts submitted in competition for these prizes should reach the secretary of the Institute of France before the first of Oc-

tober of the year in which the prize is to be awarded. The customary regulations governing such prize competitions obtain, especially the one requiring the author of a manuscript to conceal his identity by adopting a device, motto, or nom-de-plume as a means of future identification.

WE learn from *Nature* that the gold medal for the solution of the prize problem set by the faculty of mathematics and natural science of the University of Heidelberg has been awarded to Mr. ERNEST STEVENS, of Brighton, England, for his determination of the velocities of various gases and vapors at different temperatures.

OXFORD UNIVERSITY. The preliminary announcements of lectures for the Hilary term 1899, include the following in mathematical subjects:—By Professor W. ESSON: Synthetic geometry of conics, two lectures per week; Synthetic geometry of cubics, one lecture per week.—By Professor H. H. TURNER: Elementary mathematical astronomy (continued), two lectures per week.—By Professor E. B. ELLIOTT: Elements of elliptic functions, two lectures per week.—By Mr. J. WALKER: Optics, two lectures per week.—By Mr. J. C. ALSOP: Selected portions of mechanics and physics, three lectures per week.—Mr. E. S. CRAIG will deliver two lectures per week for the Reverend F. J. JERVIS-SMITH, the university lecturer in mechanics.

PROFESSOR FELIX KLEIN, of Göttingen, has been made a member of the Bavarian Maximilian Order of Science and Art.

DR. R. W. WILLSON has been appointed assistant professor of astronomy at Harvard University. DR. V. VARICAK has been promoted to an assistant professorship of mechanics at the University of Agram.

AT the University of Leipzig, Professor W. SCHEIBNER, the senior professor of mathematics, recently celebrated his fifty-year doctor jubilee. Professor G. WIEDEMANN, for many years at the head of the department of experimental physics, will retire at Easter of this year.

IT is proposed to erect a monument in memory of FÉLIX TISSERAND, Member of the Institute of France, at Nuits Saint-Georges (Côte d' Or), his native place. Subscriptions will be received by M. Desmazures, Reçeveur Municipal, Nuits Saint-Georges; M. Fraissinet, Observatory of Paris; M. Ragot, rue Colson, Dijon.

PROFESSOR E. O. KENDALL, of the University of Pennsylvania, died recently at the age of eighty-two years. Professor KENDALL was elected to the chair of mathematics and astronomy in the University of Pennsylvania in 1855; in 1892 he was appointed Flower professor of astronomy; in 1895 he resigned the Flower professorship in favor of Professor C. L. Doolittle, but retained the Scott professorship up to the time of his death; he was made Vice-Provost of the University in 1893, and since 1894 he was Honorary Dean of the College and Honorary Vice-Provost.

PROFESSOR BARTHOLOMEW PRICE, master of Pembroke College, Oxford University, died December 29, 1898, at the age of eighty-one years. Professor PRICE resigned the Sedleian professorship of natural philosophy in Oxford University last year after forty-five years' tenure of the chair. He is perhaps best known by his treatise on the infinitesimal calculus.

THE deaths are announced of Mr. EDWIN DUNKIN, F.R.S., the distinguished astronomer, and of Dr. W. JAJACKOWSKI, professor of mathematics in the technical high school at Lemberg.

THE seventieth anniversary, August 23, 1899, of the birth of Professor MORITZ CANTOR, of the University of Heidelberg, will be celebrated by the publication of a Festschrift, under the editorship of Professor MAX CURTZE, of Thom. The collaborators in the preparation of this anniversary volume, the first pages of which are already in the press of Teubner, are Messrs. Braunmühl, Cajori, Curtze, Dickstein, Eneström, Favaro, Gelcich, Gow, Graf, Günther, Heath, Heiberg, Hultsch, Hunrath, Lindemann, Loria, F. Müller, Mansion, Nagl, Schubert, Staigmüller, Steinschneider, A. Sturm, Suter, P. Tannery, Unger, Vailati, Wertheim, Wohlwill.

NEW PUBLICATIONS.

I. HIGHER MATHEMATICS.

BJERKNES (V.). Zur Theorie gewisser Vectorgrössen. Christiania, 1898. 8vo. 27 pp. M. 1.50

MCAULAY (A.). Octonions. Development of Clifford's biquaternions. Cambridge University Press, 1898. 8vo. 10s. 6d.