fuchsian functions, is one of the most important in the theory of functions. The general principle upon which this theorem rests should be permanently associated with the name of Poincaré.

In the execution of a task of this magnitude, it is inevitable that some errors should creep in. The reviewer is astonished at their small number. The salient features of almost every branch of the subject are presented, on the whole in a lucid manner. Some not inconsiderable improvements have been made by the author himself. He has undertaken an arduous task, and has accomplished it well. For the assistance which he has thereby given to a general understanding of this great department of mathematical learning he is entitled to our gratitude.

E. J. WILCZYNSKI.

NOTES.

A NEW edition of the Annual Register of the AMERICAN MATHEMATICAL SOCIETY will be issued in January next. Blanks for furnishing necessary information have been sent to each member. A prompt response will greatly facilitate the work of the Secretary.

THE October number (volume 25, number 4) of the *American Journal of Mathematics* contains: "The plane geometry of the point in point space of four dimensions," by C. J. KEYSER; "On the functions representing distances, and analogous functions," by H. F. BLICHFELDT; "Surfaces whose lines of curvature in one system are represented on the sphere by great circles," by L. P. EISENHART; "On the invariants of a homogeneous quadratic differential equation of the second order," by D. R. CURTISS; "Surfaces of constant mean curvature," by L. P. EISENHART.

ACCORDING to the annual list published in *Science*, 266 doctorates were conferred by American universities during the academic year 1902–1903. Of the 136 distributed among the "sciences," the following 7 are recorded with theses in mathematics: H. A. CONVERSE, Johns Hopkins University, "On a

system of hypocycloids of class three inscribed to a given 3-line, and some curves connected with it"; D. R. CURTISS, Harvard University, "Binary families in a triply connected region, with especial reference to hypergeometric families"; J. G. HUN, Johns Hopkins University, "The invariant relations of two triangles"; HELEN A. MERRILL, Yale University, "On solutions of differential equations which possess an oscillation theorem"; L. I. NEIKIRK, University of Pennsylvania, "Groups of order p^m which contain cyclic subgroups of order p^{m-3}"; C. E. STROMQUIST, Yale University, "On a special case of the generalized integral of length, together with certain contributions to the general theory"; OSWALD VEBLEN, University of Chicago, "A system of axioms for geometry."

The following Americans received the doctorate in mathematics from European universities in 1902–1903: ROBERT FLEET, Heidelberg, "Ueber Integrale partieller Differentialgleichungen"; C. L. KARPINSKI, Strassburg, "Ueber die Vertheilung der quadratischen Reste"; O. D. KELLOGG, Göttingen, "Zur Theorie der Integralgleichungen und des Dirichlet'schen Princips"; C. M. MASON, Göttingen, "Randwertaufgaben bei gewöhnlichen Differentialgleichungen"; A. B. PIERCE, Zurich, "Classification and properties of dual conical congruences."

IN connection with the third international congress of mathematicians, at Heidelberg, August 8–13, 1904, the hundredth anniversary of the birth of C. G. JACOBI will be marked by a memorial address and the issue of a memorial volume at the first general session of the congress.

A notice of the congress was published in the July BULLETIN. All correspondence should be addressed to the Secretary, Professor Dr. A. KRAZER, Westendstrasse 57, Karlsruhe.

THE German mathematical society held its annual meeting, in affiliation with that of the German scientists and physicians, at Cassel, September 21–26, under the presidency of Professor F. KLEIN. Over thirty papers and reports were announced in the preliminary programme. A report of the meeting will appear in a later number of the BULLETIN.

THE British association for the advancement of science held its annual meeting at Southport, beginning on September 9, 1903. The president of the association was Sir NORMAN LOCKYER, and the president of Section A (mathematics and physics) was Mr. C. V. BOYS.

THE Carnegie Institution has in preparation, under charge of the librarian of congress, a handbook of learned societies and institutions, which is to contain various information of importance to scholars, but not hitherto published in convenient form.

THE Prince Jablonowski Society of Leipsic announces the following subject for its prize competition concluding November 30, 1906:

"An investigation of the numbers analogous to the Bernoulli numbers, especially in the field of the elliptic functions, which admit complex multiplication."

THE Belgian royal academy of sciences proposes for 1904 the same prize question announced for the competition of 1902, viz.:

"A contribution to the algebraic and geometric theory of n-linear forms, $n > 3$."

The value of the prize is 600 francs. Papers must be in the hands of the secretary of the academy before August 1, 1904.

The academy also awards every four years the Charles Lagrange prize of 1,200 francs to the author of the best mathematical or experimental work which contributes in an important respect to the mathematical theory of the earth. Papers must be submitted before January 1, 1905.

THE several foreign universities named below offer the following courses for the winter semester of 1903–04:

UNIVERSITY OF BASEL. — By Professor H. KINKELIN: Differential and integral calculus, I, three hours; Analytic geometry, three hours; Differential equations, three hours; Seminar, two hours.

UNIVERSITY OF BERLIN. — By Professor H. A. SCHWARZ: Analytic geometry, four hours; Conics, two hours; Theory of analytic functions, four hours; Colloquium two hours; Seminar, three hours. — By Professor J. KNOBLAUCH: Differential calculus, four hours; Theory of elliptic functions, four hours; Exercises in differential calculus, one hour. — By Professor R. LEHMANN-FILHÉS: Integral calculus, four hours. — By Dr. E. LANDAU: Theory of determinants, four hours; Theory of functions, four hours; Transcendence of e and π, one hour. — By Professor F. SCHUR: Theory of algebraic equations, four hours; Theory of linear differential equations, four hours. —

By Professor G. FROBENIUS: Theory of number, four hours; Seminar, three hours.— By Professor F. H. SCHOTTKY: Theory of Abelian functions, three hours; Potential theory, three hours; Seminar, three hours — By Dr. E. ASCHKINASS: Elements of higher mathematics, two hours.

UNIVERSITY OF BERN. — By Professor J. H. GRAF: Bessel's functions, three hours; Elliptic functions, three hours; Differential equations, two hours; Differential and integral calculus, two hours; Investments and insurance, two hours; Seminars. — By Professor E. OTT: Integral calculus, two hours; Analytic geometry, II, two hours; Analytic mechanics, two hours. — By Dr. A. BENTELI: Descriptive geometry of curves, ruled surfaces, regular polyhedra, two hours; Exercises, two hours; Practical geometry, I, one hour; Surfaces of rotation, one hour; Constructive perspective, one hour. — By Professor C. MOSER: Probabilities and life insurance, one hour; Seminar, two hours. — By Dr. L. CRELLIER: Synthetic geometry, two hours; Selected chapters from geometry, two hours. — By Dr. F. R. P. GRUNER: Mathematical physics, two hours.

UNIVERSITY OF BONN. — By Professor L. HEFFTER: Introduction to higher algebra, four hours; Theory of functions of a complex variable, four hours; Exercises in theory of functions, one hour. — By Professor H. KORTUM: Theory of curve lines and surfaces, two hours; Differential and integral calculus, II, four hours; Seminar, two hours. — By Professor R. LIPSCHITZ: Theory of numbers, four hours; Seminar, two hours. — By Professor J. SOMMER: Plane projective geometry, two hours.

UNIVERSITY OF BRESLAU. — By Professor J. ROSANES: Algebraic equations, four hours; Elements of the theory of functions, two hours; Seminar, one hour. — By Professor R. STURM: Differential and integral calculus, four hours; Theory of geometric transformations, II, three hours; Seminar, two hours. — By Professor E. NEUMANN: Selected chapters from the potential theory, two hours; Seminar, two hours.

UNIVERSITY OF ERLANGEN. — By Professor P. GORDAN: Differential and integral calculus, four hours; Algebra, four hours; Seminar, three hours. — By Professor M. NOETHER: Analytic geometry, I, four hours; Analytic mechanics, four

hours; Mathematical exercises. — By Dr. A. WEHNELT: Introduction to the mathematical treatment of physics and chemistry, one hour; Exercises with Professor Schmidt, two hours.

UNIVERSITY OF FREIBURG. — By Professor J. LÜROTH: Plane analytic geometry and differential calculus, five hours; Solid analytic geometry, three hours; Seminar, one hour. — By Professor L. STICKELBERGER: Differential equations, four hours; Theory of numbers, three hours. — By Professor A. LOEWY: Algebraic analysis, four hours; Selected chapters of algebra, two hours; Seminar. — By Dr. J. KOENIGSBERGER: Partial differential equations and physical applications, two hours. — By Professor K. SEITH: Projective geometry, two hours.

UNIVERSITY OF GENEVA. — By Professor C. CALLIER: Differential and integral calculus, three hours; Rational mechanics, three hours; Higher analysis, two hours. — By Professor H. FEHR: Algebra, two hours; Analytic geometry, two hours; Plane curves, one hour; Seminar, one hour; Exercises in the calculus, two hours, and in mechanics, two hours, with Professor Callier. — By Dr. J. LYON: Determinants, one hour.

UNIVERSITY OF GIESSEN. — By Professor M. PASCH: Foundations of analysis, four hours; Introduction to the theory of invariants, two hours; Seminar, one hour. — By Professor E. NETTO: Differential and integral calculus, three hours, with exercises, two hours; Theory of algebraic equations, three hours; Seminar, one hour.

UNIVERSITY OF GRAZ. — By Professor J. FRISCHAUF: Higher analysis, three hours; Theory of numbers, two hours; Seminary, Quaternions with astronomical applications, two hours. — By Professor V. DANTSCHER: Analytic and projective solid geometry, five hours; Seminar, two hours. — By Professor J. STREISSLER: Descriptive geometry, three hours.

UNIVERSITY OF GREIFSWALD. — By Professor W. THOMÉ: Analytic geometry, four hours; Theory of hypergeometric functions, one hour; Seminar, one hour. — By Professor E. STUDY: Infinitesimal calculus, II, four hours; Geometry in the complex field, two hours; Exercises in the calculus, one hour; Seminar. — By Professor G. KOWALEWSKI: Function theory, II, elliptic functions, four hours; Exercises in the theory, one hour; Theory of continued fractions, one hour.

UNIVERSITY OF HALLE. — By Professor G. CANTOR: Differential and integral calculus, II, four hours; Seminar, one hour. — By Professor A. WANGERIN: Theory of potential and spherical functions, four hours; Elliptic functions, II, with applications, three hours; Solid analytic geometry, two hours; Seminar, one hour. — By Professor V. EBERHARD: Linear equations and determinants, two hours; Elements of the theory of functions, two hours; Exercises, one hour.

UNIVERSITY OF HEIDELBERG. — By Professor L. KÖNIGSBERGER: Theory of elliptic functions, two hours; Selected chapters from the integral calculus, two hours; Seminar, two hours; Analytic mechanics, four hours. — By Professor M. CANTOR: Differential and integral calculus, four hours; Exercises, one hour; Political arithmetic, two hours. — By Professor F. EISENLOHR: Differential and integral calculus, five hours; Theory of potential, two hours; Theoretical optics, four hours. — By Professor K. KOEHLER: Solid analytic geometry, three hours. — By Professor G. LANDSBERG: Descriptive geometry, four hours; Theory of curved lines and surfaces, four hours.

UNIVERSITY OF INNSBRUCK. — By Professor OTTO STOLZ: Differential and integral calculus, four hours; Arithmetic, II, complex numbers, one hour; Theory of functions (Weierstrass), one hour. — By Professor W. WIRTINGER: Theory of numbers, three hours; Elliptic functions, two hours; Seminar, two hours. — By Professor K. ZINDLER: Descriptive geometry, four hours.

UNIVERSITY OF KIEL. — By Professor L. POCHHAMMER: Solid geometry, three hours; Differential equations with one independent variable, three hours; Seminar, one hour. — By Professor P. STÄCKEL: Integral calculus, three hours; Elliptic functions, four hours; Seminar, Elliptic functions, one hour.

UNIVERSITY OF KÖNIGSBERG. — By Professor F. MEYER: Solid analytic geometry and projective geometry, four hours, with exercises, one hour; Analytic mechanics, four hours, with exercises, one hour. — By Professor A. SCHOENFLIES: Introduction to higher mathematics, two hours; Theory of functions, four hours; Seminar, two hours. — By Professor L. SAALSCHÜTZ: Higher differential quotients and inversion of series, two hours; Theory of numbers, two hours. — By Dr. T. VAHLEN: Integral calculus, four hours, with exercises, one hour; Descriptive geometry, four hours.

UNIVERSITY OF LAUSANNE. — By Professor H. AMSTEIN: Differential and integral calculus, I, six hours; II, two hours; Exercises, three hours; Theory of functions, three hours; Calculus for scientists, three hours. — By Professor H. JOLY: Descriptive geometry, I, five hours; Exercises, one hour; Analytic geometry, two hours; Geometry of position, two hours; Plane curves, two hours.

UNIVERSITY OF LEIPSIC. — By Professor K. NEUMANN: Analytic mechanics, four hours; Mathematical Seminar, two hours. — By Professor O. HÖLDER: Differential and integral calculus, five hours; Selected chapters from the theory of elliptic modular functions, two hours; Seminar, one hour. — By Professor F. ENGEL. — Solid analytic geometry, two hours; Theory of functions, four hours; Transformation groups and differential equations, two hours; Seminar, one hour. — By Professor F. HAUSDORFF: Algebra and determinants, two hours.

UNIVERSITY OF MARBURG. — By Professor E. HESS: Solid geometry treated analytically and synthetically, four hours; Algebraic equations and determinants, four hours; Seminar, two hours. — By Professor K. HENSEL: Integral calculus, five hours; Differential equations, four hours; Seminar, two hours. — By Dr. F. VON DALWIGK: General theory of surfaces and space curves, four hours. — By Dr. H. JUNG: Algebraic analysis, four hours; Calculus of variations, four hours; Exercises in the calculus, two hours.

UNIVERSITY OF MUNICH. — By Professor G. BAUER: Seminar. — By Professor F. LINDEMANN: Differential calculus; Theory of abelian functions; Seminar, (*a*) automorphic functions, (*b*) applications of elliptic functions. — By Dr. K. DÖHLEMANN: Descriptive geometry, I, with exercises; Modern synthetic geometry, with exercises. — By Dr. H. K. BRUNN: Algebra and determinants. — By Professor E. VON WEBER: Introduction to the theory of analytic functions; Differential geometry. — By Professor ANDING: Probabilities and least squares.

UNIVERSITY OF MÜNSTER. — By Professor W. KILLING: Potential theory, four hours; Differential and integral calculus, II, three hours; Noneuclidean geometry, two hours; Seminar, two hours; Exercises in the calculus, one hour. — By Professor

R. VON LILIENTHAL: Analytic geometry, II, four hours; Theory of curves and surfaces, four hours; Political arithmetic, two hours; Seminar, one hour. — By Dr. M. DEHN: Algebra, two hours; Irrational numbers and the quadrature of the circle, two hours.

UNIVERSITY OF NEUCHÂTEL. — By Professor L. ISELY: Infinitesimal calculus, two hours; History of mathematics in French Switzerland, three hours. — By Professor L. GABEREL: Theory of functions, three hours.

UNIVERSITY OF PRAGUE.—By Professor G. PICK: Functions of a complex variable, three hours; Theory of numbers, two hours; Seminar, two hours. — By Professor J. A. GMEINER: Differential calculus, three hours; Space curves and surfaces, two hours. — By Dr. W. WEISS: Projective geometry, two hours.

UNIVERSITY OF ROSTOCK. — By Professor O. STAUDE: Plane analytic geometry, four hours; Algebra, four hours; Seminar, two hours.

UNIVERSITY OF STRASSBURG. — By Professor T. REYE: Solid analytic geometry, modern methods, three hours; Mathematical theory of elasticity, two hours; Seminar, two hours. — By Professor H. WEBER: Differential and integral calculus, four hours; Theory of elliptic functions, four hours; Seminar, two hours. — By Professor G. ROTH: Algebraic analysis and determinants, three hours; Solid analytic geometry, two hours; Ordinary differential equations, two hours. — By Professor M. DISTELI: Plane analytic geometry, three hours; Graphic statics, two hours; Exercises, two hours; Seminar, two hours. — By Dr. P. EPSTEIN. — Differential geometry, theory of curves and surfaces, three hours.

UNIVERSITY OF TÜBINGEN. — By Professor A. VON BRILL: Introduction to higher mathematics, four hours; Theory of algebraic curves, three hours; Seminar, two hours. — By Professor H. STAHL: Higher analysis, II, four hours; Partial differential equations, three hours; Seminar, two hours. — By Professor L. MAURER: Elliptic functions, two hours; Exercises, one hour; Descriptive geometry, II, one hour; Exercises, two hours.

UNIVERSITY OF VIENNA. — By Professor G. VON ESCHERICH: Definite integrals, five hours; Proseminar, one hour;

Seminar, two hours. — By Professor F. MERTENS: Differential and integral calculus; Proseminar, one hour; Seminar, two hours. — By Professor G. KOHN: Analytic geometry, four hours, with exercises, one hour; Curves and surfaces of the third order, two hours. — By Dr. A. TAUBER: Theory of functions, four hours; Mathematics of insurance, four hours. — By Dr. E. BLASCHKE: Introduction of mathematical statistics, II, three hours. — By Dr. R. DAUBLEBSKY VON STERNECK: Division of the circle, and Kummer's numbers, two hours. — By Dr. K. CARDA: Differential geometry, two hours. — By Dr. J. PLEMELJ: Theory of numbers, two hours. — By Dr. GRÜNWALD: Fourier's series and integrals, one hour.

UNIVERSITY OF WÜRZBURG. — By Professor F. PRYM: Differential calculus, with an introduction to the higher analysis, five hours; Seminar, exercises in the calculus, two hours; Selected chapters from higher mathematics, two hours. — By Professor E. SELLING: Integration of ordinary differential equations, four hours. — By Professor G. ROST: Solid analytic geometry, four hours; Plane analytic geometry, four hours; Seminar, geometry, two hours; Determinants, two hours.

UNIVERSITY OF ZURICH. — By Professor H. BURKHARDT: Differential and integral calculus, four hours; Seminar, two hours. — By Professor A. WEILER: Analytic geometry, I, three hours; Descriptive geometry, I, three hours; Synthetic geometry, three hours; Analytic geometry, two hours; Algebra, two hours. — By Dr. E. GUBLER: Algebraic analysis, two hours; Theory of numbers, continued, one hour; Teaching of mathematics, two hours.

THE technical high schools named below offer the following courses in mathematics for the winter semester of 1903–04.

AIX-LA-CHAPELLE. — By Professor E. JÜRGENS: Higher mathematics. — By Professor F. KÖTTER: Descriptive geometry; Graphic statics. — By Professor H. VON MANGOLDT; Higher mathematics, II; Seminar; Commercial mathematics; Insurance.

BERLIN. — By Professor O. DZIOBEK: Higher mathematics. — By Professor E. HAENTZSCHEL: Differential and integral calculus; Analytic geometry. — By Professor G. HAUCK: Descriptive geometry, I. — By Professor H. HERT-

ZER: Descriptive geometry, I. — By Professor G. HETTNER: Higher mathematics; Theory of curves and surfaces. — By Professor S. JOLLES: Descriptive geometry, I; Graphic statics. — By Professor E. LAMPE: Higher mathematics; Definite integrals and differential equations. — By Professor E. STEINITZ: Theory of potential; Theory of functions; Algebra; Synthetic geometry.— By Dr. HESSENBERG; Descriptive geometry, II. — By Dr. E. JAHNKE: Vectors and their application to mechanics; Repetitorium on analytic geometry and the calculus. — By Professor S. KALISCHER: Theory of potential; Mechanics. — By Dr. R. MILLER: Differential and integral calculus.

BRÜNN. — By Professor O. BIERMANN: Selected chapters from higher mathematics, II, four hours; Approximation methods, two hours; Graphic computation, one hour. — By Professor O. RUPP: Descriptive geometry, six hours. — By Dr. F. OBENRAUCH: History of geometry, one hour.

BRUNSWICK. — By Professor R. DEDEKIND: Theory of numbers; Fourier's series. — By Professor R. FRICKE: Analytic geometry and algebra; Differential and integral calculus; Theory of potential; Analytic mechanics. — By Professor R. MÜLLER: Descriptive geometry; Geometry of position; Geometry of motion; Stereometry; Perspective constructions. — By Professor A. WERNICKE: Foundations of higher mathematics.

CARLSRUHE. — By Professor R. K. H. HAUSSNER: Differential geometry, two hours. — By Professor A. KRAZER: Theory of functions, two hours; Higher mathematics, II, three hours. — By Professor F. SCHUR: Descriptive geometry, four hours, with exercises, four hours; Graphical statics, two hours; Modern synthetic geometry, two hours. — By Professor L. F. WEDEKIND: Higher mathematics, I, six hours, with exercises, two hours.

HANOVER. — By Professor L. KIEPERT: Differential and integral calculus, five hours, with exercises, one hour: Geometry of position, three hours; selected chapters from higher mathematics, three hours. — By Professor C. RUNGE: Differential and integral calculus, four hours, with exercises, one hour; Plane and solid analytic geometry, three hours. — By Professor C. RODENBERG: Descriptive geometry, I, three hours, with exercises, six hours; II, three hours, with exercises, six hours.

MUNICH. — By Professor W. VON DYCK: Higher mathematics, I, with exercises; Introduction to the Cayley-Riemann function theory. — By Professor S. FINSTERWALDER: Higher mathematics, III, with exercises; Seminar, with Professor von Dyck. — By Professor A. VON BRAUNMÜHL: Elements of higher mathematics, I, with exercises; Algebraic analysis, with exercises; Seminar in the history of mathematics. — By Professor L. BURMESTER: Descriptive geometry, I, with exercises. — By Professor ANDING: Probabilities and least squares.

STUTTGART. — By Professor K. REUSCHLE: Curves; Solid analytic geometry; Modern analytic geometry of the plane and of space; Differential and integral calculus; Seminar. — By Professor R. MEHMKE: Descriptive geometry; Pure mechanics; Seminar. — By Dr. E. WÖLFFING: Theory of functions, I; Differential and integral calculus.

THE list of rectors for the present academic year of the German technical high schools includes the following mathematicians: Berlin, Professor G. HETTNER; Darmstadt, Professor F. DINGELDEY; Hanover, Professor L. KIEPERT; Munich, Professor W. VON DYCK. Professor G. VON ESCHERICH has been elected rector of the University of Vienna, and Professor J. ROSANES rector of the University of Breslau.

PROFESSOR R. LIPSCHITZ, of the University of Bonn, recently celebrated his semi-centennial doctorate anniversary.

THE following recent academic promotions and appointments are reported: Dr. E. VON WEBER has been promoted to a professorship at the University of Munich, Dr. G. ROST to a professorship at Würzburg, Dr. E. NAETSCH to a professorship at the Dresden technical high school. Dr. E. STEINITZ has been promoted to succeed the late Professor M. Hamburger at the Berlin technical high school. DR. A. THUE has been appointed professor of applied mathematics in the University of Christiania.

DR. A. G. HALL, of the University of Michigan, has been appointed assistant professor of mathematics in the University of Illinois. Dr. A. B. PIERCE and Mr. T. R. RUNNING have been appointed instructors in mathematics at the University of Michigan.

MR. L. C. WALKER has been appointed head of the department of mathematics in the Colorado school of mines.

PROFESSOR J. B. SHAW, of Kenyon College, has been appointed professor of mathematics in the James Millikin University, Decatur, Ill.

DR. C. N. HASKINS has been appointed instructor in mathematics in the Sheffield Scientific School of Yale University.

DR. H. L. RIETZ has been appointed instructor in mathematics at the University of Illinois.

DR. H. F. STECKER has been appointed instructor in mathematics at the Pennsylvania State College.

THE following appointments are also announced: Dr. J. G. HUN as instructor in mathematics in Princeton University; Mr. J. E. STOCKER as instructor in mathematics in Lehigh University; Mr. J. D. FLYNN as instructor in mathematics in Trinity College, Hartford, Conn.; Mr. E. I. SHEPARD as instructor in mathematics in Williams College; Mr. J. A. SWENSON as assistant in mathematics in Columbia University.

PROFESSOR O. RÖTHIG died at Berlin, June 14. Professor S. VECCHI, of the University of Parma, died May 23. Professor E. WEYR, of the Bohemian technical high school at Prague, died July 23, at the age of fifty-one years.

PROFESSOR B. G. BROWN, for thirty-five years professor of mathematics at Tufts College, died September 29, at the age of sixty-six years.

THE following catalogues of second-hand mathematical works have recently appeared: List and Francke, 2 Thalstrasse, Leipsic, catalogue no. 354, 1156 works on mathematics, besides physical and astronomical works; A. Nardecchia, 42 Via dell' Università, Rome, 415 works on mathematics.