A', B', C', E' being the minors corresponding to a, b, c, e in the Wronskian

$$W = \left| a, \quad \frac{db}{ds}, \quad \frac{d^2c}{ds^2}, \quad \frac{d^3e}{ds^3} \right|.$$

The above values for the curvatures are derived directly by Pirondini in *Battaglini's Journal* for 1890.

PRINCETON, NEW JERSEY.

NOTES.

THE closing (October) number of Volume I of the *Transactions* of the AMERICAN MATHEMATICAL SOCIETY contains the following papers : "On surfaces enveloped by spheres belonging to a linear spherical complex," by P. F. SMITH ; "On certain relations among the theta constants," by J. I. HUTCHINSON ; "On groups which have the same group of isomorphisms," by G. A. MILLER ; "Die Hesse'sche und die Cayley'sche Curve," by P. GORDAN ; "Application of a method of D'Alembert to the proof of Sturm's theorem of comparison," by M. BÔCHER ; "Two plane movements generating quartic scrolls," by E. M. BLAKE ; "The invariant theory of the inversion group : geometry upon a quadric surface," by E. KASNER ; "A simple proof of the fundamental Cauchy-Goursat theorem." by E. H. MOORE ; "Notes and errata : Volume I."

THE mathematical section of the British association for the advancement of science held its meeting at Bradford, September 10, 1900, with Major P. A. MacMahon, F.R.S. as presiding officer, and Mr. E. T. Whittaker, secretary. The following papers were read :

(1) MISS F. HARDCASTLE : Report (preliminary) on the present state of the theory of point groups.

(2) MAJOR P. A. MACMAHON : "A property of the characteristic symbolic determinant of any n quantics in n variables."

(3) PROFESSOR CYPARISSOS STEPHANOS : "Sur les relations entre la géométrie projective et la mécanique."

(4) Mr. H. S. CARSLAW : "The use of multiple space in applied mathematics."

(5) MAJOR P. A. MACMAHON : "The asyzygetic and perpetuant covariants of systems of binary quantics."

(6) LIEUT.-COL. ALLAN CUNNINGHAM : "Determination of successive high primes."

(7) Mr. A. B. BASSET : "A quintic curve cannot have more than fifteen real points of inflexion."

(8) MAJOR P. A. MACMAHON : "On the symbolism appropriate to the study of orthogonal and Boolian invariant systems which appertain to binary and other quantics."

(9) DR. J. WILLIS : "On the construction of magic squares."

(10) PROFESSOR J. D. EVERETT: "On a central-difference interpolation formula."

(11) PROFESSOR EVERETT : "On Newton's contributions to central-difference interpolation."

The committee appointed in 1888 to calculate tables of certain mathematical functions presented a report of their year's progress. The work on which they have for some time been engaged, namely, the preparation of a new "Canon Arithmeticus," is now almost completed. The calculations were made by Lieut.-Col. ALLAN CUNNINGHAM.

FOR volumes IV. and V. of the Encyclopædia of the mathematical sciences, edited by H. BURKHARDT, and W. FR. MEYER (see BULLETIN, 2d series, volume 3, p. 326 ; volume 4, p. 32 ; volume 5, pp. 109, 151, 202, 266) ; the following list of collaborators and subjects is announced :

Volume IV : Mechanics.—A. Introduction : 1. The principles of rational mechanics, A. Voss, of Würzburg.—B. Mechanics of Points and Rigid Systems : I. Geometric foundation and development of concrete modes of representation : 2. Theory of systems of vectors and screws, H. E. TIMERDING, of Strassburg ; 3, Geometry of masses, G. JUNG, of Milan ; 4. Kinematics, A. SCHOENFLIESS, of Königsberg ; 5. Elementary statics, including graphical statics, L. HENNEBERG, of Darmstadt ; 6. Elementary kinetics, J. PETERSEN, of Copenhagen. II. General analytical treatment of arbitrary systems with finite degrees of freedom : 7. General developments, P. STÄCKEL, of Kiel ; 8. Complete treatment of special cases, P. STÄCKEL of Kiel ; 9. Mathematical treatment of the problem of n bodies, E. T. WHITTAKER, of Cambridge, Eng. III. Applications, with consideration of disturbing influences : 10. Mechanics of the simplest kinds of physical apparatus and of experiments, PH. FURTWÄNGLER, of Potsdam ; 11. Kinetic problems of machines, K. HEUN, of Berlin ; 12. Ballistics, C. CRANZ, of Stuttgart ; 13. Sports, G. T. WALKER, of Cambridge, Eng.—C. Mechanics of Deformable Bodies. I. Analytical geometrical

aids: 14. Vector analysis, M. ABRAHAM, of Göttingen. II. Hydrodynamics: 15. Physical foundation, A. E. H. LOVE, of Oxford; 16. Theoretical developments, A. E. H. LOVE, of Oxford; 17. Hydraulics, part one: Flow of water in pipes, canals, etc., E. PALADINI, of Milan; 18. Hydraulics, part two: Motors and pumps, M. GRÜBLER, of Charlottenburg; 19. Motion of ships, A. KRILOFF, of St. Petersburg; 20. Aerodynamics, S. FINSTERWALDER, of Munich. III. Theory of elasticity: 21. Physical foundation, A. SOMMERFELD, of Aachen; 22. Theoretical treat· ment of statical problems, O. TEDONE, of Genoa; 23. Statics of building construction, E. OVAZZA, of Palermo; 24. Vibrations, in particular acoustics, H. LAMB, of Manchester, Eng.; 25. Theory of measuring apparatus based upon elastic effects, PH. FURTWÄNGLER, of Potsdam.—D. Mechanics of Systems Consisting of very Numerous Discrete Particles: 26. The application of the theory of probabilities, L. BOLTZMANN, of Leipsic.

Volume V: Physics.—A. Introduction: 1. Measures and measurement, C. RUNGE, of Hanover; 2. General properties of bodies, Gravity, J. ZENNECK, of Strassburg.—B. Thermodynamics: 3. General foundations of thermodynamics, G. H. BRYAN, of Upper Bangor, Wales; 4. Special substances and conditions, H. KAMERLINGH-ONNES, of Leiden, and J. KORTEWEG, of Amsterdam; 5. Dissipation of energy, including conduction of heat, E. W. HOBSON, of Cambridge, Eng.; 6. Technical theory of heat, H. LORENZ, of Halle, and E. RIECKE, of Göttingen.—C. Molecular Physics: 7. Fundamental notions concerning atoms and molecules; a. Introductory remarks on the atomic theory, L. BOLTZMANN, of Leipsic; b. The mathematical foundations of chemistry, W. MEYERHOFFER, of Berlin; 8. Crystallography; a. Theory of symmetry and structure, A. SCHOENFLIESS and O. MÜGGE, of Königsberg; b. Computation and drawing of crystals, TH. LIEBISCH, of Göttingen; 9. Kinetic theory of gases, L. BOLTZMANN, of Leipsic; 10. Capillarity and cohesion, H. MINKOWSKI, of Zurich; 11. Physical chemistry and electrochemistry, J. H. VAN'T HOFF, of Berlin.—D. Electricity and Optics: Physical foundations of the theory of electricity. 12. Action at a distance, laws governing elements, R. REIFF, of Stuttgart; 13. Action of a field, Maxwell's theory and allied topics, H. A. LORENTZ, of Leiden; 14. Further developments of Maxwell's theory, Electron-theory, H. A. LORENTZ, of Leiden.—Special mathematical developments in the theory of electricity. 15. Electrostatics and magnetostatics, H. M.

MACDONALD, of Cambridge, Eng.; 16. Relations between electricity and elastic deformation, F. POCKELS, of Heidelberg ; 17. Stationary and slowly changing fields (electric currents, induction, and electrodynamics in the narrower sense), A. TAUBER, of Vienna ; 18. Relations of the electric current to heat and magnetism, H. DIESSELHORST, of Berlin ; 19. Rapidly changing fields, M. ABRAHAM, of Göttingen ; 20. Technical electricity, TH. DESCOUDRES, of Göttingen.—Physical foundations of optics. 21. Older theories, A. WANGERIN, of Halle ; 22. Electromagnetic theory of light, W. WIEN, of Würzburg ; 23. The part played by molecular physics and the electron-theory in optics, W. WIEN, of Würzburg.—Special mathematical developments in optics.   24. Ray treatment of optics and optical instruments, S. FINSTERWALDER, of Munich ; 25. Wave treatment of optics (interference and refraction), K. STREHL, of Erlangen ; 26. Optics of crystals, F. POCKELS, of Heidelberg.—E. Conclusion : 27. General physical notions and methods, A. SOMMERFELD, of Aachen, and J. LARMOR, of Cambridge, Eng.

CAMBRIDGE UNIVERSITY.—Advanced mathematical courses for the current academic year are announced as follows :

Michaelmas term. 1900 :—By Professor Sir G. G. STOKES : Hydrodynamics, three hours.—By Professor A. R. FORSYTH : Abel's theorem and abelian functions, three hours ; Invariants and covariants, two hours.—By Professor G. H. DARWIN : Lunar theory, three hours.—By Mr. R. PENDLEBURY: Theory of equations, three hours.—By Dr. E. W. HOBSON : Spherical and cylindrical harmonics, three hours.—By Mr. J. LARMOR : Electricity and magnetism, three hours.—By Mr. H. F. BAKER : Continuous groups, three hours.—By. Mr. H. M. MACDONALD : Waves (especially waves of light), three hours.—By Mr. H. W. RICHMOND : Plane analytical geometry, three hours.—By Mr. G. T. WALKER : The electro-magnetic field, three hours.—By Mr. E. T. WHITTAKER : The problem of three bodies, three hours.—By Mr. J. H. GRACE : Invariants and geometrical applications, three hours.

Lent term, 1901 :—By Professor Sir G. G. STOKES : Physical optics, three hours.—By Professor A. R. FORSYTH : Invariants and covariants (symbolical methods), three hours.—Fourier's and other expansion theorems, two hours.—By Professor Sir R. S. BALL : Planetary theory, three hours.—By Mr. R. PENDLEBURY : Theory of numbers, three hours.—By Dr. E. W. HOBSON : Vibrations and

sound, three hours.—By Mr. J. LARMOR : Electricity and magnetism (continued, more advanced), three hours.—By Mr. H. F. BAKER : Discontinuous groups, three hours.—By Mr. H. M. MACDONALD : Elasticity, three hours.—By Dr. J. W. L. GLAISHER : Elliptic functions, three hours.—By Mr. A. BERRY : Elliptic functions, three hours.—By Mr. G. T. WALKER : Physical optics, three hours.—By Mr. G. T. BEN-NETT : Linear and quadratic complexes, three hours.—By Mr. E. T. WHITTAKER : Linear differential equations of the second order.

Easter term, 1901 :—By Professor G. H. DARWIN : Figure of the earth and precession, three hours.—By Mr. W. L. MOLLISON : Theory of potential and electrostatics.—By Mr. A. N. WHITEHEAD : Non-euclidean geometry.—By Mr. G. T. WALKER : Rigid dynamics, three hours.—By Mr. I'A. BROMWICH : Algebra of matrices and bilinear forms.

Long vacation, 1901 :—By Professor Sir R. S. BALL : Theory of screws, two hours.

THE several universities below offer during the winter semester 1900–1901 courses in mathematics as follows :

UNIVERSITY OF STRASSBURG.—By Professor T. REYE : Geometry of position, three hours ; Analytical mechanics, two hours ; Seminar, two hours.—By Professor H. WEBER : Elliptic functions, four hours ; Selected chapters of higher algebra, two hours ; Seminar in coöperation with Dr. WELL-STEIN.—By Professor G. ROTH : Algebraic analysis and de-terminants, three hours ; Analytical geometry of space, two hours ; Ordinary differential equations, two hours.—By Professor A. KRAZER : Infinitesimal calculus, four hours ; Plane analytical geometry, three hours ; Seminar, two hours.—By Dr. H. E. TIMERDING : Introduction to higher analysis, two hours ; Elasticity and rigidity, one hour.— By Dr. J. WELLSTEIN : Descriptive geometry I, two hours, with exercises ; Seminar, with Professor WEBER.

UNIVERSITY OF TÜBINGEN.—By Professor A. v. BRILL : Introduction to higher mathematics, four hours; On non-rigid systems and the mechanics of Hertz, three hours ; Seminar, two hours.—By Professor H. STAHL : Higher algebra, three hours ; application of the theory of func-tions, four hours ; Seminar, two hours.—By Professor L. MAURER : Higher analysis II, two hours, with exercises, one hour ; Spherical trigonometry, one hour, with exer-cises, one hour ; Theory of numbers, two hours.

UNIVERSITY OF WÜRZBURG.—By Professor F. PRYM :

Differential calculus, four hours, with exercises, two hours ; Higher theory of functions, four hours ; Seminar in higher mathematics, two hours.—By Professor A. Voss : Introduction to the theory of differential equations, four hours ; Application of the infinitesimal calculus to the theory of curves and surfaces, four hours ; Seminar, in analytical and synthetical geometry of conics, two hours.

UNIVERSITY OF VIENNA.—By Professor J. V. ESCHERICH : Definite integrals and differential equations, five hours ; Proseminar, one hour ; Seminar, two hours.—By Professor L. GEGENBAUER : Algebra III, two hours ; Theory of numbers, three hours ; Proseminar, one hour ; Seminar, two hours.—By Professor F. MERTENS : Elements of infinitesimal calculus for students of all faculties, with exercises, five hours ; Proseminar, one hour ; Seminar, two hours.—By Professor G. KOHN : Introduction to synthetic geometry, four hours, with exercises, one hour ; Algebraic plane curves, one hour.—By Dr. V. SERSAWY : Mathematics of insurance, two courses of three and four hours, respectively.—By Dr. A. TAUBER : Analytical mechanics, three hours ; Mathematics of insurance, four hours, with exercises, two hours.—By Dr. E. BLASCHKE : Introduction to mathematical statistics, three hours.—By Dr. K. ZSIG-MONDY : Surfaces of second order, one hour.—By Dr. R. D. V. STERNECK : Differential geometry, three hours.

UNIVERSITY OF ZÜRICH.—By Professor H. BURKHARDT : Infinitesimal calculus, four hours ; Differential equations, four hours ; Seminar, two hours.—By Professor A. WEILER : Analytical geometry, with exercises, four hours ; Descriptive geometry, with exercises, four hours ; Synthetic geometry, two hours ; Mathematical geography, two hours.—By Dr. F. KRAFT : Modern synthetic geometry, four hours ; Analytical geometry, two hours ; Analytical mechanics, four hours ; Exercises in higher mathematics, two hours.—By Dr. E. GUBLER : Theory and resolution of higher equations, with exercises, three hours ; Methods of mathematical instruction in secondary schools, two hours ; Spherical trigonometry, one hour.

THE Göttingen Academy of Sciences has awarded 800 marks to Professor F. KLEIN for his work on the Mathematical Encyclopædia.

PROFESSOR W. DYCK has been appointed director of the Technical High School in Munich for the next three years.

DR. J. B. FAUGHT, recently assistant professor of mathe-

matics in the University of Indiana, has been appointed professor of mathematics in the Northern Michigan State Normal School, Marquette, Mich.

DR. D. F. CAMPBELL, of the Lawrence Scientific School, Harvard University, has been appointed instructor in mathematics in the Armour Institute of Technology, Chicago, Ill.

DR. G. A. BLISS has been appointed instructor in mathematics at the University of Minnesota.

MR. W. B. FORD has been appointed instructor in mathematics in the University of Michigan.

PROFESSOR F. H. LOUD has resumed his duties at Colorado College after two years' leave of absence.

PROFESSOR E. J. TOWNSEND has returned to his position at the University of Illinois after two years of study at the University of Göttingen.

PROFESSOR I. STRINGHAM has returned to the University of California, after a year of travel in Europe.

PROFESSOR B. O. PEIRCE, of Harvard University, has been granted a year's leave of absence.

PROFESSOR S. J. BROWN, astronomical director of the Naval Observatory, has been appointed superintendent of the Nautical Almanac, to succeed Professor H. T. TODD, who was retired by age on August 25th.

PROFESSOR R. E. ALLARDICE, of Leland Stanford University, is spending a year abroad on leave of absence.

NEW PUBLICATIONS.

I. HIGHER MATHEMATICS.

ABEL (N. H.). Abhandlung über eine besondere Klasse algebraisch auflösbarer Gleichungen. (1829.) Herausgegeben von A. Loewy. Leipzig, Engelmann, 1900. 12mo. 50 pp. (Ostwald's Klassiker der exakten Wissenschaften, No. 111.) Cloth.   M. 0.90

BEER (F.). Kriterien für die Irrazionalität von Funktionalwerten. (Diss.) Göttingen, 1899. 8vo. 61 pp.

BEINHORN (J.). Zur Theorie der quadratischen Formen. (Diss.) Marburg, 1900. 8vo. 42 pp.

BINDER (J. K.). Ueber eine gewisse Abbildung zweier Rotationshyperboloide auf einander. (Diss.) Leipzig, 1900. 8vo. 81 pp., 4 plates.