sound wave is the intersection of the two hyperbolas. In actual practice, the hyperbolas are not plotted, but it is assumed that the source of the sound wave lies on the asymptotes. An asymptote correction is applied to compensate for the error of this assumption. A second correction compensates for the varying time of travel of the sound wave due to the velocity and direction of the wind. A third correction compensates for variations in the time of travel of the sound wave due to departure of the temperature of the air from standard. The problem admits of graphical solution, but requires personnel of high intelligence and excellent training.

12. Miss May gave a summary of the developments in aeronautics during the past few years.

13. Professor Swingle made an abstraction of several fundamental definitions of topology, and discussed the possible domain of application.

14. Professor Boldyreff considered the existence and uniqueness of decomposition of a rational fraction into partial fractions, and the explicit formulas for the numerators of the partial fractions for all cases. The numerical properties of the coefficients were investigated in connection with the numerators of partial fractions corresponding to repeated prime quadratic factors.

H. D. LARSEN, *Secretary*

THE EIGHTEENTH ANNUAL MEETING OF THE INDIANA SECTION

The eighteenth annual meeting of the Indiana Section of the Mathematical Association of America was held Friday and Saturday, May 2 and 3, 1941, at Butler University, Indianapolis, Indiana.

Seventy-five registered at the meetings, including the following thirty-five members of the Association: W. C. Arnold, Emil Artin, Max Astrachan, Juna Lutz Beal, I. W. Burr, W. W. Denton, R. H. Downing, W. E. Edington, P. D. Edwards, B. C. Getchell, E. L. Godfrey, G. H. Graves, W. R. Hardman, H. H. Hartzler, Cora B. Hennel, H. K. Hughes, M. W. Keller, W. C. Krathwohl, Cornelius Lanczos, D. A. Lehman, Florence Long, H. A. Meyer, C. N. Moore, P. M. Pepper, J. C. Polley, D. H. Porter, C. K. Robbins, L. S. Shively, D. R. Shreve, W. O. Shriner, Anna K. Suter, M. S. Webster, Agnes E. Wells, F. J. Weyl, H. E. Wolfe.

At the business meeting on Saturday the following officers were elected for next year: Chairman, P. D. Edwards, Ball State Teachers College; Vice-Chairman, J. C. Polley, Wabash College; Secretary, M. W. Keller, Purdue University. On account of the increased number of papers being presented it was voted that the Indiana Section of the Association should hold two meetings per year. The spring meetings will be continued and a second meeting will be held jointly with the Mathematics Section of the Indiana Academy of Science. The first joint meeting with the Indiana Academy will be held at DePauw University in November, 1941.

At the annual dinner on Friday evening Professor Beal of Butler University served as toastmaster and introduced Dr. D. S. Robinson, president of Butler University, who welcomed the visitors. Dr. Robinson paid tribute to the importance of the study of mathematics to the student of philosophy, in which field he achieved national prominence before taking over his duties as president of Butler University.

Following the dinner the first session of the Section was held, at which time Professor C. N. Moore of the University of Cincinnati was guest speaker. His subject was "On the interdependence of pure and applied mathematics." Professor Moore pointed out that the history of mathematics reveals many instances in which the methods needed for the solution of an applied problem had been developed far in advance of the need, in the course of the natural growth of mathematical theory. Likewise, the study of an applied problem has frequently raised questions which stimulated extensive developments in the field of pure mathematics. This mutual relationship between the pure and applied branches of the subject was illustrated by means of various special cases of particular importance.

At the two sessions on Saturday the following program was presented:

1. "And gladly teach" by Professor Cora B. Hennel, Indiana University, retiring chairman of the Indiana Section.

2. "Predicting class quality on the basis of orientation tests" by Professor W. C. Krathwohl, Illinois Institute of Technology, by invitation.

3. "Further findings from the diagnostic testing program" by Dr. M. W. Keller and Dr. D. R. Shreve, Purdue University.

4. "A report of pre-college mathematics by correspondence" by Dr. D. R. Shreve and Dr. M. W. Keller, Purdue University.

5. "The appeal of useful mathematics" by Professor Emeritus D. A. Lehman, Goshen College.

6. "After sectionizing; what?" by Professor Max Astrachan and Professor I. W. Burr, Antioch College.

7. "History of mathematics in Indiana" by Professor W. E. Edington, DePauw University.

8. "Fundamental properties of the Gamma function" by Professor Emil Artin, Indiana University.

9. "The motion of a particle in a Riemannian world" by Professor Cornelius Lanczos, Purdue University.

10. "The value of the p-adic logarithm" by David Gilbarg, Indiana University, introduced by Professor Artin.

11. "A locus related to the Euler line" by K. W. Crain, Purdue University, introduced by Professor Graves.

12. "Value distribution of ring meromorphic functions" by Dr. F. J. Weyl, Indiana University.

13. "Automorphisms of a simple algebra" by Dr. G. W. Whaples, Indiana University, introduced by Professor Artin.

Abstracts of papers follow, the numbers corresponding to the numbers in the list of titles:

1. Professor Hennel discussed the responsibility of mathematics teachers for rendering various types of service. Teachers must serve as investigators, contributing to the development of the subject in its pure and applied phases; as historians, recording and evaluating subject-matter and writing biographies; as teachers, instructing students in the different branches of mathematics; as writers of text-books; and as faculty members, working toward the all-around development of students. Special emphasis was placed on the importance of the work as teacher. Too often promotions in the college field are based on the work in the first two fields with the result that there is neglect of the primary purpose for which the undergraduate school is organized.

2. Professor Krathwohl presented some results of investigations carried out at the Illinois Institute of Technology. At the time of the first meeting, it is possible by means of such tests as the Iowa Placement Mathematics Aptitude Examination and the American Council Psychological Examination to predict the quality of a freshman class in mathematics. Because standards and types of students vary in different colleges, the constants involved in the computation have to be computed separately for each institution. The advantage of such a prediction is that if an instructor has a weak class, he knows he must work much harder on fundamentals. If he has an unusually good class, he can use this fine opportunity to enrich the content of the course.

3. Dr. Keller presented a second progress report on the diagnostic testing program which has been inaugurated at Purdue University. Some of the findings from the results of two years of testing were given. In addition, the ability of students to perform the fundamental operations with exponents and radicals as revealed by the revised tests which were given in 1940–1941 was discussed briefly.

4. Dr. Shreve presented a report on the results of an experimental review course given by correspondence to 230 students planning to enter Purdue University. The study shows (1) an analysis of the types of errors prevalent among entering students, (2) a discussion of the opportunities for remedial work by the university before the student enters, and (3) a report on the noticeable achievements of the course. The study indicates that the university can, by pre-college training, prepare students to compete with superior students with equal success in a single course. Following the study of the results of this course, Purdue University now offers this pre-college course by correspondence as a regular summer project.

5. Professor Lehman discussed a large number of applications of elementary mathematics which are not ordinarily found in elementary texts. These included applications to surveying problems and problems in astronomy, as well as the more familiar problems commonly found in text-books.

6. Professor Astrachan described the Antioch program in mathematics as developed by himself and Professor Burr. There is a horizontal sectionizing on

the basis of high school records and placement tests. Candidates for the Bachelor of Science degree are given the usual training in algebra, trigonometry, analytics, and calculus. Emphasis is primarily on skills and applications. The courses taken by candidates for the Bachelor of Arts degree are planned to be of a more cultural nature. They include, among other things, certain skills useful in many fields and in everyday intelligent living. Advanced courses included some aspects of modern mathematics. Procedure in most courses is on a laboratory basis. Achievement is measured by a system of quizzes which test the mastery of all material as it is covered.

7. Professor Edington discussed the growth of instruction in mathematics in Indiana. The Territory of Indiana was organized in 1800 and the Territorial Legislature, following special action by congress in 1804, passed acts in 1806 and 1807 leading to the incorporation of Vincennes University. These acts required, among other things, the instruction of the youth in mathematics. During the next twenty-five years Indiana University, Hanover, and Wabash Colleges were founded and instruction in algebra, geometry, navigation, and surveying was offered. By 1850 trigonometry and analytic geometry were regularly offered in several of the colleges, and some work in fluxions was given. Following the Civil War the growth of colleges in number, enrollment, and curriculum offerings was more rapid. The first M.A. degree in mathematics granted within the state was conferred on Joseph Swain by Indiana University in 1885. The first Ph.D. in mathematics was granted by Purdue University to James Byrnie Shaw in 1897, but no other Ph.D. degree in mathematics was granted within the state until 1912 when Miss Cora B. Hennel received this degree from Indiana University. Following are the names of the more prominent early mathematicians of Indiana: Bishop Matthew Simpson, John Steele Thomson, John H. Harney, J. Harrison Thomson, John S. Hougham, Emerson E. White, Frank L. Morse, Moses C. Stevens, Erastus Test, John L. Campbell, John P. D. John, Henry T. Eddy, Joseph Swain, Clarence A. Waldo, Arthur S. Hathaway, and Robert J. Aley.

8. Professor Artin showed that the fundamental properties of the Gamma function are derived in a very simple manner if the function be defined as a logarithmic-convex solution of its functional equation. The main reason for the simplicity of the proofs is that the logarithmic-convex functions form a family that is closed under addition, multiplication, and the taking of limits. With very little formal manipulation of symbols Professor Artin was able to obtain all the usual forms which are used to define the Gamma function.

9. Professor Lanczos discussed the motion of a particle in a Riemannian field. Linear differential equations satisfy the principle of superposition; two separate solutions can be superposed on each other without any disturbance. Hence, linear differential equations cannot account for the fact that a particle is put in motion by the action of a superposed external field. The field equations of relativity, based on Riemannian geometry, are non-linear. Thus the possibility is given that here the dynamics of a particle may be understood as a con-

sequence of the field equations. Indeed, the laws of motion can be derived in the form of integral relations based on the Gaussian integral transformation. The equations of motion come out in the classical Newtonian form: 1. The time rate of change of the momentum is equal to the moving force. 2. The momentum is equal to the total mass times the velocity of the center of the mass. The "moving force" can be transformed into a boundary integral, extended over the surface of the particle. The resulting law of motion does not coincide necessarily with the customarily assumed law of the geodesic line.

10. Mr. Gilbarg defined the p-adic absolute value on the rational numbers in the following way: If $m/n=(m'/n')\,p^{+n}$, then the absolute value of $m/n=p^{-n}$. By means of this sort of absolute value, it is possible to define convergence. In particular, the convergence of the logarithmic series can be discussed from this point of view. The problem of the values taken on by the logarithm function in the p-adic domain was considered.

11. Mr. Crain employed the analytic method to establish the following results: (1) If a circle is cut by a straight line in two points A and B, the locus of the circumcenters of the triangle PAB, where P is any point on the given circle, is a point circle, and the locus of the orthocenters is a circle. (2) The locus of any point, which divides in a constant ratio the line joining the circumcenter and the orthocenter, is a circle. (3) Each member of this family of circles is tangent to two lines which intersect at the circumcenter. (4) Considering only the members of this family which form an unlimited chain of tangent circles, and starting with the circle determined by the orthocenters, their radii taken in decreasing order may be summed.

12. Dr. Weyl's paper was concerned with a generalization of R. Nevanlinna's now classical results about the distribution of meromorphic functions (R. Nevanlinna, *Eindeutige Analytische Funktionen*, Julius Springer, 1936). The principal aim of this theory is the characterization of the class of functions, one-valued on a given Riemann surface F, in terms of the distribution of those places where any one of them assumes given values. If F is the doubly punctured sphere, the corresponding class of functions is called ring-meromorphic. If F is open, one is forced to exhaust it by means of a sequence of ever-expanding regions. For the principal estimates of the classical theory it is furthermore imperative that the exhausting regions exhibit rotational symmetry. How to do this in the classical case, where F is the open euclidean plane, is evident. But the sphere, punctured at the south and north poles, also permits an exhaustion by rotationally symmetric regions. On this basis the classical procedure as well as its results can be reproduced, throwing into sharp relief their dependence on the above symmetry.

13. Dr. Whaples gave a new, simplified proof of the theorem that two isomorphic simple sub-algebras of a simple algebra are connected by an inner automorphism.

P. D. Edwards, *Secretary*