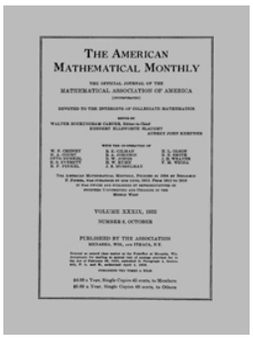

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The Ninth Annual Meeting of the Indiana Section

H. T. Davis (Secretary-Treasurer)

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However, even Eddington admits the desirability, for certain practical purposes, of using Deterministic means as a sort of "symbolic operational" method for obtaining results quickly and conveniently. For astronomical purposes, for example, we could continue to use what may be called, perhaps, "Astronomical Determinism," to calculate results, whereas for Electron Physics we could make use of the "Indeterministic" or "Secondary" Laws (as Eddington terms them), that is, the Probability Methods of the New Quantum Mechanics. Between these two extreme cases, however, there would be a set of intermediate cases And this would lead us into logical difficulties, for the notion of Probability has no recognized place in classical Deductive Logic. Furthermore, Determinism enters the scientific arena mainly through the door of Deductive Logic, and if we are to modify Determinism we will have to modify our whole system of thinking. The necessity for such a fundamental revision of our methods of reasoning is strongly suggested in Eddington's statement that while naive realism, materialism, and the Mechanistic Hypothesis were simple, yet it was only by closing our eyes to the essential nature of experience that they could be made to seem credible. Suppose now, it were possible to construct a multiple-valued Logical System (instead of the simple Two-valued System of classical Logic, as exemplified, for instance, in Whitehead and Russell's Principia Mathematica) of such a sort that it could constitute a valid and satisfactory basis for a whole set of distinct Theories of Sets; then the way would be open for the introduction of the notion of Probability into Deductive Logic, and the logical difficulties mentioned above might be smoothed out. Now, as a result of the work of Chwistek (Mathematische Zeitschrift, Vols. 26 and 30), and of Lesniewski, Tarski, Lukasiewicz, Greniewski, and others, together with the fundamental work of Korzybski (a forthcoming book by him will explain the work of the Polish School), a start in this direction has already been made, and a multi-valued system has actually been constructed, and looks to be very promising for the purposes mentioned.

12. This paper discusses the process of "rounding off" as applied to numbers, the absolute and relative errors in sums, differences, products and quotients. Mention is made of the accuracy in connection with logarithms and trigonometric functions. The reverse problem is taken up, namely, the allowable error in the data if there is a certain desired accuracy in the result.

W. W. RANKIN, *Secretary*

THE NINTH ANNUAL MEETING OF THE INDIANA SECTION

The ninth annual meeting of the Indiana Section of the Mathematical Association of America was held on Friday and Saturday, May 6, and 7, 1932, at Butler University, Indianapolis, Indiana.

There were sixty present at the meeting including the following twenty-six members of the Association:

Gladys L. Banes, G. A. Bliss, Stanley Bolks, G. E. Carscallen, H. T. Davis, J. E. Dotterer, W. E. Edington, P. D. Edwards, E. D. Grant, G. H. Graves, H. E. H. Greenleaf, F. H. Hodge, H. K. Hughes, E. N. Johnson, E. L. Klinger, Juna M. Lutz, T. E. Mason, H. A. Meyer, T. W. Moore, Eunice C. Orr, Saul Pollock, J. A. Reising, C. K. Robbins, L. S. Shively, R. O. Virts, K. P. Williams.

On Friday afternoon at 5:30 a reception was given to the visiting members and their guests which was followed by a banquet attended by fifty-five persons. Dean J. W. Putnam of Butler University officiated as toast master and made an address of welcome to the members of the Section and their guests. Responses were made by Professor Carscallen of Wabash College, chairman of the Section, Professor Edington of De Pauw University and Professor Cora B. Hennel of Indiana University.

At 8:15 a public lecture was given by Professor G. A. Bliss of the University of Chicago on the subject, "The Structures of Pure and Applied Mathematical Sciences." In this address Professor Bliss characterized pure mathematical science as consisting of postulates, definitions, and theorems. The theory of the real number system based upon four simple postulates for positive integers was cited as an example. The structure of an applied mathematical science is similar except that the usefulness of the theory depends upon the accuracy with which the postulates correspond to simple observed data, and the logical conclusions of the theory to the results of more complicated observations. It is not true that there is a unique mathematical theory for the correlation of a particular set of natural phenomena. On account of the looseness of the fit between theory and observation, which is always present, a multiplicity of theories for the correlation of the same set of observed data is always possible. Euclidean and non-Euclidean theories of plane geometry, the Ptolemaic and Copernican theories in astronomy, and the various quantum theories were described briefly as illustrations.

Following the address of Professor Bliss, Professor Saul Pollock, of the Indiana State Teachers' College at Terre Haute, gave a public exhibition of "Skew Curve Projection." This exhibition consisted in the creation of space curves by throwing light upon string models of various types of surfaces. By means of the device of photographing curves of high order and using these lantern slides in turn to generate new space curves, it was possible to obtain curves of remarkably high orders.

At the session on Saturday morning, presided over by Professor G. E. Carscallen, Wabash College, chairman, the following officers were elected: Professor K. P. Williams, Indiana University, Chairman; Professor Juna M. Lutz, Butler University, vice-Chairman; Professor H. T. Davis, Indiana University, Secretary-Treasurer.

A chairman's address was made by Professor G. E. Carscallen on the subject, "The Pathology of Mathematics." In this address Professor Carscallen called attention to the fact that "educational research" during the past two or

three decades has encroached by leaps and bounds upon other departments in college and university curricula. This encroachment presents to mathematics in particular an especial menace, since too many people, ignorant of its aims and unappreciative of its importance, have attempted foolish modifications of the mathematics courses both in intermediate and college teaching. Present low standards of attainment by graduates are attributable to these causes. The speaker cited the lowered standards of the North Central Association with regard to mathematics as an evidence of this dangerous trend. Professor Carscallen particularly urged the members of the Indiana Section to take a more vigorous part in the framing of curricula and in other activities where the cause of mathematics could be more effectively defended.

By special invitation Dr. Cornelius Lanczos of Frankfort University, Germany, and Purdue University, made an hour's address on the subject, "An Elementary Development of Riemannian Geometry with Application to Relativity." In this address Dr. Lanczos considered the geometry of the line element, $ds^2 = g_{11}dx_1^2 + 2g_{12}dx_1dx_2 + g_{22}dx_2^2$, and showed how interpretations in Euclidean geometry could be generalized in the Riemannian and Lobachevskian cases. Making use of the variation principle applied to the line integral $I = \int ds$, the speaker showed how the mechanics of the Keplerian orbits could be obtained as an interpretation of the geometrical picture. Proceeding from this elegant discussion, the speaker carried the generalization into four dimensions and showed how the mechanics of the Einstein physics came as a natural consequence of the geometrical considerations.

The remainder of the program consisted of the following papers. Due to illness Professor Heath was unable to give his paper, but was represented by George Manning of Franklin College.

1. "A study in Keplerian elliptic motion" by M. Wiles Keller, Indiana University, by invitation.

2. "Functions analogous to Hermite polynomials in the problem of curve fitting" by Professor H. E. H. Greenleaf, De Pauw University.

3. "Language, logic, and mathematics" by Dr. A. F. Bentley, Paoli, Indiana, by invitation.

4. "Maxima and minima of radii of curves" by Professor F. H. Hodge, Purdue University.

5. "Some composite polyhedrons" by Professor D. H. Heath, Franklin College.

6. "A new technique in the analysis of trend lines" by Professor H. T. Davis, Indiana University.

7. "Higher geometry in the college curriculum" by Professor J. E. Dotterer, Manchester College.

8. "Some elementary geometrical applications of group theory" by Professor W. E. Edington, De Pauw University.

Abstracts of the papers follow, the numbers corresponding to the list of titles.

1. In this paper the expression for the angular velocity about a point between the foci in Keplerian elliptic motion was determined and the cubic equation derived, the roots of which give the values for which the angular velocity is a maximum and a minimum. Some of the properties of this cubic, the coefficients of which depend upon two parameters, were given and their relationship to the angular velocity noted.

2. Professor Greenleaf discussed the least-square approximation to data in which the variates are equally spaced and the observed frequencies are given the binomial coefficients as weighting factors. By a method parallel to the Gram-Charlier development of continuous variates in the type-A curve, a set of functions analogous to the Hermite polynomials were found for discrete variates. These functions have a generating function and a recurrence formula; each satisfies a given difference equation of second order, and has an orthogonality property similar to that of the Hermite polynomials. The coefficients to be used with these functions are computed and tabulated, permitting the determination of the least-square equation with a minimum amount of computation.

At the close of the paper Professor E. H. Hildebrandt of De Pauw University discussed these functions showing how they fit into the general system of polynomials connected with the Charlier expansion, using his paper published in the Annals of Mathematical Statistics, November, 1931, as the basis of his discussion.

3. Dr. Bentley undertook to show the manner in which language, logic and mathematics may be inspected as differentiated aspects of that historical field of human behavior, indicated by the word "knowledge" and by various associated terms. For the investigation of this common field a procedure to be called "Semantic Analysis" was suggested as wider in scope and more powerful than logic. Semantic Analysis in this sense is closely akin to Korzybski's Non-Aristotelian Semantics, but basically different from Chwistek's Semantik. The recent trend towards the reconstruction of logic in the work of Russell, Hilbert, Brouwer, Chwistek, Lukasiewicz, Tarski, Lesniewski and Korzybski was briefly sketched.

4. In testing for the maximum or minimum values of the radius of curvature of the parabola, $y^2=4ax$, differentiation with respect to x fails to indicate the origin as a critical point while differentiation with respect to y does indicate this point. In the case of the ellipse in standard form, differentiation with respect to x indicates one pair of points while differentiation with respect to y indicates another pair. Similar results are found for the hyperbola. The aim of this paper is to point out the apparent exceptions to ordinary rules and to indicate the reasons for these conditions.

5. In this paper models were presented showing families of solids formed by the combinations of the regular convex polyhedrons. Professor Heath presented to the members of the Association pamphlets of patterns for the construction of twelve of these solids, as, for example, the formation of a solid composed of equal octohedrons mounted on each face of an icosahedron.

6. In the analysis of series of economic items, as, for example, the Dow Jones stock market averages, pig iron production, etc., it is desirable to have a technique for fitting trend lines of higher degree than the straight line and also to be able to compute the correlations of the deviations of these series from their trend lines. By means of simple formulas involving quadratic forms of the moments of the series it is possible to solve this problem in the sense of least squares. Explicit formulas for the coefficients of the forms in terms of the number of items and tables of their values are given for polynomials from the first to the seventh degrees inclusive. The speaker indicated the application of these formulas in an elaborate computation of economic constants which is being made by the Cowles Commission for Research in Economics of Colorado Springs, an affiliate of the Econometric Society.

7. In this paper Professor Dotterer presented the case of higher geometry in the college curriculum. He indicated the scope of this subject which seems desirable for presentation to undergraduates and pointed out the many contacts which this study makes with other mathematical disciplines.

8. In this paper Professor Edington discussed the results obtained by permuting the coefficients of such equations as $y=ax^2+bx+c$, $x^2+y^2+ax+by+c=0$, $ax+by+c=0$, and indicated the generalizations and some of the geometrical relations associated with group concepts. It was also pointed out that Veronese in 1881 had discovered that the permutations of the homogeneous coordinates of a point in a plane gave six points which are the vertices of a Pascal hexagon, and Professor Edington showed that the plane is divided up into regions such that if a point is taken from a given region, the kind of conic determined by the six points is always of the same kind. The extension to space was also indicated.

Resolutions were adopted by the members of the section expressing their appreciation and thanks to the authorities of Butler University for their hospitality, to Professor Bliss, Professor Pollock, and Professor Lanczos for their contributions to the program, and to the Mathematics Section of the State Teachers' Association and the Extension Division of Indiana University for their efforts in stimulating mathematical study through the recently inaugurated state wide contest in mathematics for high school study.

H. T. DAVIS, *Secretary-Treasurer*

THE THIRTEENTH ANNUAL MEETING OF THE ILLINOIS SECTION

The thirteenth annual meeting of the Illinois Section of the Mathematical Association of America was held at the University of Illinois, on Friday and Saturday, May 6 and 7, 1932.

The attendance was about ninety, including the following forty-five members of the Association: Beulah M. Armstrong, Edith I. Atkin, H. W. Bailey,