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### THE OCTOBER MEETING OF THE INDIANA SECTION

A joint meeting of the Indiana Section of the Mathematical Association of America and the Mathematics Division of the Indiana Academy of Science was held at DePauw University, Greencastle, Indiana, on October 18, 1957. Professor I. W. Burr, Chairman of the Mathematics Division of the Academy, presided.

There were 69 in attendance including 37 members of the Association.

The following papers were presented:

1. *The mathematics of the future*, by Professor P. D. Edwards and Professor C. F. Brumfiel, Ball State Teachers College.

Professor Edwards stressed the increasing importance of having high school teachers of mathematics who are much more thoroughly trained in advanced mathematics than was considered necessary a relatively few years ago. This applies not only to the traditional topics needed by the engineer and the physical scientist but also to the needs of workers in other fields. It was pointed out that very definite improvements in the teachers' preparation may be made by drastic changes in the content of high school mathematics. Professor Brumfiel made a progress report on an experimental program now being supervised by Ball State which was made possible by a grant from the National Science Foundation.

2. *A characterization of  $n$ -adic equivalence relations*, by Professor J. L. Lawrence, Wabash College and International Business Machines, introduced by the Secretary.

The concepts of symmetry, transitivity, composition, and equivalence associated with dyadic relations were generalized to apply to the  $n$ -adic case. In the generalized scheme, symmetry and transitivity persist as necessary and sufficient conditions for an  $n$ -adic relation to be an equivalence relation. Furthermore, as in the dyadic case, an  $n$ -adic relation is transitive if and only if the relation contains the composition of the relation with itself.

3. *The concept of surface integral*, by Mr. L. H. Turner, Purdue University, introduced by the Secretary.

A continuous parametric surface  $(T, A)$  is a continuous mapping  $T$  from a subset  $A$  of  $E_2$  into three space  $E_3$ ,  $p = T(w)$ ,  $w = (u, v) \in A$ ,  $p = (x, y, z) \in E_3$ . The usual definition of area in terms of the Jacobians of the mapping is inadequate in modern analysis. An adequate definition was given by Lebesgue in terms of sequences of polyhedral mappings which approach the original mapping. When the area is finite, four measures  $\phi$ ,  $V_1$ ,  $V_2$ ,  $V_3$  may be defined by means of these sequences on a certain ring of Borel subsets of  $A$  such that  $V_1$ ,  $V_2$ , and  $V_3$  are absolutely continuous with respect to  $\phi$ . The Radon-Nikodym derivatives  $\theta_1(w) = dV_1/d\phi$ ,  $\theta_2(w) = dV_2/d\phi$ ,  $\theta_3(w) = dV_3/d\phi$  exist and satisfy  $\theta_1^2 + \theta_2^2 + \theta_3^2 = 1$  a.e. ( $\phi$ ). The vector  $\theta(w) = (\theta_1, \theta_2, \theta_3)$  may be thought of as the directional normal to the surface  $(T, A)$  at  $T(w)$ . Then if  $D = \{(\theta_1, \theta_2, \theta_3) : \theta_1^2 + \theta_2^2 + \theta_3^2 = 1\}$  and  $f(x, y, z, \theta_1, \theta_2, \theta_3)$  is any function which is Borel measurable and bounded on  $T(A) \times D$ , the integral  $H(T, A, f) = (A) \int f(T(w), \theta(w)) d\phi$  exists and is the integral of  $f$  over  $(T, A)$ .

4. *Periodic solutions of nonlinear differential equations*, by Professor W. R. Fuller, Purdue University.

In this paper, which was expository in nature, were indicated some types of nonlinear differential equations and systems of such equations, for which existence theorems for periodic solutions have been studied. This includes systems containing a small parameter,  $\epsilon$ , which for  $\epsilon = 0$  have periodic solutions. In particular the study of systems of the form  $\dot{x} + \sigma^2 x = \epsilon f(x, t; \epsilon)$  where  $\sigma^2 x$  and  $f$  are  $n$ -vectors has been very fruitfully attacked by a method of L. Cesari which has been applied to a wide class of problems by Cesari, Hale, Gambill, Bailey and the author (see, e.g., Atti Acad. Italia, vol. 11, 1940, pp. 633–692; Bull. AMS 60, 1954, pp. 64–66, 367; 62, 1956, p. 567; 63, 1957, p. 271).

5. *Localization experiment for teaching geometry*, by Professor A. D. Hummel, Ball State Teachers College, introduced by the Secretary.

A method of determining the  $x$ ,  $y$ , and  $z$  coordinates of points within a body by means of X-rays was reviewed. Projected images of scales are used as measuring sticks in two radiographs. The source of the X-rays has different positions for the two radiographs. Elementary geometry is used to compute the coordinates of any point appearing in both. In the experiment described for teaching, a small source of visible light is substituted for the X-ray source. Data obtained from shadows is used to calculate the length of the object. Verification of the result by direct measurement should strengthen the students' faith in geometry.

6. *Undergraduate curricula—some brave experiments and cogent lessons*, by Professor A. E. Ross, University of Notre Dame.

There are many critical problems which confront one in the task of implementing an effective undergraduate program in mathematics. Today such a program must not only appeal to the people who have traditionally relied upon mathematical tools, but it must also appeal to the users of new mathematics, most of whom come from the humanities, from commerce, and from the "preprofessional" groups. The novelty of the new undergraduate curriculum lies not only in the new content but also in the growing recognition that mathematical manipulative skills alone do not develop the capacity for intelligent application nor do these skills alone justify considering mathematics as one of the liberal arts. To design a proper blending of the new and the old, of ideals and of skills, and to make this blend accessible to the very young brings us close to the fundamental questions in the art of communication. The purpose of this talk was to discuss and to illustrate some of these questions.

7. *A graphical solution for a particular finite series*, by Dr. R. H. L. Howe, Eli Lilly and Company, Lafayette, Indiana, introduced by the Secretary.

There are problems in engineering and the physical sciences which require the evaluation of  $y$  given as a finite series of the form  $y = 1/x_1 + \dots + 1/x_n$ , where  $x_1, \dots, x_n$  are positive or negative real numbers. Let  $y = 1/R$ . Then  $R$  can be found graphically using a simple geometric principle. When a large number of terms is involved, this graphical method is particularly time saving. It is thus very useful in checking problems such as those concerning resistance of resistors in parallel, capacity of condensers in series, focal length in optical systems, and total resistance or conduction coefficient of materials in heat transfer and transmission.

8. *On the inter-relationship of applications and mathematical research*, by Dr. K. L. Nielsen, U. S. Naval Avionics Facility, Indianapolis, Indiana.

Emphasizing the constant increase and breadth of scope in the utilization of mathematics in contemporary nonmathematical fields, the author concentrated primarily on the inter-relationship between mathematical research and some technological developments, electronic calculating machines, and the philosophy of education. He discussed the role of the mathematician in industry, industry's utilization of mathematics, the development of new mathematics, and the need for closer cooperation between the educators and those engaged in research and the application of mathematics.

J. C. POLLEY, *Secretary*

#### THE NOVEMBER MEETING OF THE NEW JERSEY SECTION

The second annual meeting of the New Jersey Section of the Mathematical Association of America was held at Fairleigh Dickinson University, Rutherford, New Jersey, on November 2, 1957. Dean A. E. Meder Jr., retiring Chairman of the Section, presided at the morning session; Dean C. W. Black, Fairleigh Dickinson University, presided at the luncheon and during the address by Dr. Morris Meister; and Professor B. E. Meserve, newly-elected Chairman of the Section, presided at the afternoon session. 104 persons registered.