APRIL MEETING OF THE ROCKY MOUNTAIN SECTION

The thirtieth annual meeting of the Rocky Mountain Section of the Mathematical Association of America was held at the University of Wyoming, Laramie, Wyoming, on April 18 and 19, 1947. There were three sessions, with Professor Greta Neubauer of the University of Wyoming presiding at each.

There were sixty-four persons in attendance, including the following twenty-five members of the Association: C. F. Barr, D. L. Barrick, J. R. Britton, A. G. Clark, G. S. Cook, A. T. Craig, A. B. Farnell, H. T. Guard, Mrs. Leota C. Hayward, I. L. Hebel, C. A. Hutchinson, A. J. Kempner, Claribel Kendall, A. J. Lewis, A. E. Mallory, W. K. Nelson, K. L. Noble, O. H. Rechard, A. W. Recht, L. W. Rutland, Jr., Nathan Schwid, S. R. Smith, L. C. Snively, V. J. Varineau, Mrs. Lillie C. Walters.

At the business meeting the following officers were elected for the coming year: Chairman, H. T. Guard, Colorado State College of A. and M. A.; Vice-Chairman, I. L. Hebel, Colorado School of Mines; Secretary-Treasurer, J. R. Britton, University of Colorado. Invitations to meet at Colorado State College of A. and M. A. in 1948, and at Colorado School of Mines in 1949 were accepted.

The following papers were presented:

1. *Expansion of an arbitrary function in series of functions associated with Bessel functions*, by Professor Leonard Bristow, University of Wyoming, introduced by Professor C. F. Barr.

The author defined a set of functions by generalizing the Poisson integrals for Bessel and for Struve functions. For a suitable arbitrary function there was obtained an expansion resembling the generalized Schlomilch series.

2. *The solution of an integral equation*, by Professor W. H. Jurney, Colorado School of Mines, introduced by Professor I. L. Hebel.

3. *Note on functions of a matrix*, by Professor Clarence Ross, University of Denver, introduced by A. J. Lewis.

The matrix e^{kt} was expanded into a polynomial in k of degree not greater than $n-1$, where k is an $n \times n$ matrix. An application to the solution of linear homogeneous differential equations was explained.

4. *Bounds for the characteristic roots of a matrix*, by Professor A. B. Farnell, University of Colorado.

A brief history of this subject and related topics was presented. Let $\mathbf{A} = (a_{rs})$ be a square matrix of order n with complex numbers as elements. The equation $|\lambda\mathbf{I} - \mathbf{A}| = 0$, where $\mathbf{I}$ is the unit matrix and λ is a scalar, is called the characteristic equation of the matrix $\mathbf{A}$, and the roots λ_i, the characteristic roots. Several

new bounds for the characteristic roots were given. Let

$$\sum_s |a_{rs}| = R_r, \quad \sum_r |a_{rs}| = T_s, \quad \sum_s |a_{rs}| R_r = U_r, \quad \sum_r |a_{rs}| T_s = V_r.$$

Then $|\lambda|$ is not larger than any of the three numbers $\max_r (U_r)^{1/2}$, $\max_r (V_r)^{1/2}$, $\max_r (U_r V_r)^{1/4}$.

5. *A new method of approximating Fourier coefficients*, by G. L. Collins, Colorado School of Mines, introduced by Professor I. L. Hebel.

This speaker presented a simple method for evaluating the Fourier coefficients of a curve plotted to a predetermined scale. The essential idea of the method consisted of the use of a series of specially ruled transparent plastic sheets.

6. *Wallis' product for* π, by W. W. Mitchell, Jr., University of Colorado, introduced by Professor A. J. Kempner.

It was shown how Wallis determined the value of π between ever narrowing upper and lower bounds by a process of interpolation in a sequence of numbers related to the first quadrant areas under the curves $y=(1-x^2)^n$, $n=0, 1, 2, \cdots$.

7. *On complex roots of algebraic equations*, by Professor A. J. Kempner, University of Colorado.

Given an equation $f(z)=a_0z^n+\cdots+a^n=0$ with real coefficients and roots $z_k=x_k+iy_k$, $k=1, \cdots, n$, one knows how to establish by rational operations equations $G(x)=0$, and $H(y)=0$, each of degree n, such that each x_k is among the roots of the first, each y_k among the roots of the second equation. However, this leaves in each equation n^2-n roots unaccounted for. The location of these roots is determined by the theorem: The n roots of $G(x)=0$ are $x_j=\frac{1}{2}(z_k+z_l)$, $k, l=1, 2, \cdots, n$; the n roots of $H(y)=0$ are $y_j=\frac{1}{2}(z_k-z_l)$. A striking geometrical interpretation in the plane of complex numbers is possible.

Results are extended in toto to equations with complex coefficients without raising the degrees of $f(z)$, $G(x)$, $H(y)$ by letting $z=u+v$ with the restriction that with $u+v$, the number $u-v$ is also a root of $f(z)=0$. The function $G(x)$ is of the form $f(x)\cdot K^2(x)$, K being of degree $(n^2-n)/2$; $H(y)$ is of the form $y^nL(y^2)$, L being of degree $(n^2-n)/2$ in y^2. Similar results hold for the equation for r and for $e^{i\phi}$, $z=re^{i\phi}$.

8. *Statistical inference*, by Professor A. T. Craig, University of Iowa.

This paper was devoted to an exposition of the construction of a mathematical system adequate to furnish methods for drawing inferences from statistical data. The paper included an introduction to the Neyman-Pearson theory of testing statistical hypotheses.

9. *Is mathematics out of this world?* by Professor A. W. Recht, University of Denver.

The main thesis of this paper is that mathematics as presented in high schools and in colleges of liberal arts is out of this world in the sense that the principles of mathematics are set up in the classical and traditional way instead of in the

way in which they occur in real life. The suggestion is made that textbooks be written with the psychological approach by mathematicians who are also experts in fields of real application of mathematics. Problems should be presented as they occur in real life. It is only in this way that mathematics will be able to maintain the high reputation it has acquired in the atomic age; it is only in this way that students in the high schools and colleges will be kept interested in mathematics of reality, and not dazed by operations in a world of unreality.

10. *General mathematics*, by Professor Fred McCune, Colorado State College of Education.

In this paper the author asks why courses in "general" mathematics should duplicate training given in standard algebra and geometry courses. He believes that training in the fundamental skills of arithmetic is more important for the average secondary school student.

11. *The training of mathematics teachers*, by Professor K. H. Stahl, University of Colorado, introduced by the Secretary.

The attitude developed by students in mathematics has great influence not only on them, but also on us as teachers of mathematics. The teacher controls to a great extent the attitudes developed by members of the class, and it is therefore important that all teachers have a proper influence on their students. If the teacher himself is not well grounded in the material to be presented, it is quite unlikely that his influence will be wholesome. In all probability many persons become certified to teach in the elementary schools with very poor backgrounds in arithmetic. It is recommended that college teachers concern themselves with the mathematical preparation of elementary teachers.

12. *Report on the entrance requirement changes at the University of Colorado*, by Professor A. J. Kempner, University of Colorado.

Professor Kempner reported on the recent changes in entrance requirements for the Colleges of Arts and Sciences at the University of Colorado. All students must now offer three units of high school English, besides nine other units in "academic" subjects. These may not be selected arbitrarily; but students may enter the College without any high school work in any chosen one of the four large fields: foreign language, mathematics, natural sciences, social sciences. Under some arrangements students may even enter without any high school work in any chosen two of these fields.

There is opposition within the faculty to this scheme. Departments were not properly consulted.

In mathematics the situation is aggravated by the fact that a student who offers mathematics on his entrance requirements may substitute "high school arithmetic" and "general mathematics" for high school algebra and high school geometry which were required under the old rule.

Criticism of this last regulation centers around the fact that "general mathematics," as the term is understood in our part of the country, represents mathe-

matics courses which were introduced specifically for students who were either admittedly incapable of carrying the standard algebra and geometry courses, or who did not intend to go on to college training, but who wanted vocational courses in mathematics with a minimum of emphasis on theory and logical development. The department of mathematics refuses to recognize these courses as adequate prerequisites for college mathematics. These courses must not be confused with "unified mathematics" courses, which in some parts of the country go under the name of "general mathematics." For these, a strong case can be made out.

The mathematics department consulted groups of Colorado high school teachers, particularly mathematics teachers. The results were revealing. Over a hundred mathematics teachers of the Denver Section of C. E. A. protested unanimously against the changes. The Grand Junction Section, one of the other two sections in the state, sent a similar protest. The mathematics departments of two of the large Denver high schools, Denver North and Denver East, sent unanimous petitions to the president of the University, and so forth.

High school administrators generally favor the new rules, and regret that they do not go farther than they do. There exists scattered disapproval among them, but it has so far not become organized.

Our experience in Colorado proves that we have powerful allies among the high school teachers; they suffer and chafe under the steady deterioration of the standards and are, at least in Colorado, as a group more aware of the dangers and implications of the situation, and far more willing to fight for its improvement, than are college and university faculties.

In the lively discussion which followed the speaker's remarks, sentiment was opposed overwhelmingly to the elimination of mathematics as an entrance requirement, and as bitterly opposed to the admission of high school arithmetic and "general mathematics" in place of algebra and geometry.

J. R. BRITTON, *Secretary*

APRIL MEETING OF THE LOUISIANA-MISSISSIPPI SECTION

The twenty-fourth annual meeting of the Louisiana-Mississippi Section of the Mathematical Association of America was held at Mississippi Southern College, Hattiesburg, Mississippi, on Friday and Saturday, April 25 and 26, 1947. Professor W. V. Parker, Chairman of the Section, presided at the Friday afternoon and Saturday morning sessions. Professor W. L. Johnson, Vice-Chairman for Mississippi, presided at the joint dinner with the Louisiana-Mississippi Branch of the National Council of Teachers of Mathematics.

The attendance was sixty-five including the following thirty members of the Association: T. A. Bickerstaff, H. E. Buchanan, Margaret R. Davis, W. L. Duren, Jr., L. M. Garrison, F. C. Gentry, A. Gilmore, W. C. Griffith, W. L. Johnson, H. T. Karnes, C. G. Killen, Z. L. Loflin, Dorothy McCoy, A. C. Maddox, B. E. Mitchell, S. B. Murray, I. C. Nichols, W. V. Parker, P. K. Rees, F. A. Rickey,