

The April Meeting of the Rocky Mountain Section Source: *The American Mathematical Monthly*, Vol. 59, No. 2 (Feb., 1952), pp. 142-144 Published by: <u>Mathematical Association of America</u> Stable URL: <u>http://www.jstor.org/stable/2307138</u> Accessed: 18/01/2015 20:46

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Since it is desirable for students in the natural science area to complete the calculus by the end of their sophomore year at the latest, and since it is not possible to assume that a beginning freshman has any knowledge of trigonometry, it is proposed that trigonometry be made an incidental part of a course in analytic geometry. The material of trigonometry can be presented as an application of the analytic method and can replace other illustrations. In particular, the theorem of Pythagoras in its analytic form (the "distance formula") leads immediately to the law of cosines and to the addition formulas. It was the opinion of the speaker that the point of view that this approach would entail would serve the student's needs far more than the excessive emphasis on the solution of triangles which is so often found in standard courses in trigonometry.

12. A note on the effect of high school preparation in mathematics as measured by the Nebraska mathematics classification examination, by H. M. Cox, University of Nebraska.

Questions on general mathematics (Part I) and questions on elementary high school algebra (Part II) differentiate sharply between students with two (or less) and three (or more) semesters of high school algebra. However, and for the effective use of the examination, there occur gradations in ascending order of mean score in accordance with the amount and variety of high school courses in mathematics. The Nebraska examination correlates satisfactorily with Section VI (Mathematics) of the Cooperative General Culture Test.

LULU L. RUNGE, Secretary

THE APRIL MEETING OF THE ROCKY MOUNTAIN SECTION

The thirty-fourth annual meeting of the Rocky Mountain Section of the Mathematical Association of America was held at the Colorado State College of Education, Greeley, Colorado, on Friday and Saturday, April 20 and 21, 1951. Professor Dale O. Patterson, Chairman of the Section, presided at all the sessions.

Of the approximately one hundred thirty persons who registered, the following fifty were members of the Association: C. F. Barr, W. E. Briggs, J. R. Britton, R. G. Buschman, F. M. Carpenter, A. G. Clark, C. H. Cook, G. S. Cook, David Devol, Mary C. Doremus, A. B. Farnell, F. N. Fisch, R. R. Gutzman, Leota C. Hayward, I. L. Hebel, LeRoy Holubar, Burrowes Hunt, C. A. Hutchinson, B. W. Jones, M. W. Jones, A. J. Kempner, Claribel Kendall, J. S. Leech, Garner McCrossen, H. C. McKenzie, M. L. Madison, D. C. B. Marsh, Jr., W. K. Nelson, Greta Neubauer, K. L. Noble, D. O. Patterson, H. C. Peterson, Lily B. Powell, G. B. Rice, O. H. Rechard, A. W. Recht, L. W. Rutland, Jr.. Nathan Schwid, W. N. Smith, L. C. Snively, M. E. Sperline, K. H. Stahl, P. O. Steen, J. F. Stockman, E. P. Tovani, E. L. Vanderburgh, V. J. Varineau, W. W, Varner, J. F. Wagner, Lillie Walters.

At the business meeting, it was voted to hold the next annual meeting at Western State College, Gunnison, Colorado, in May, 1952. The following officers were elected for the ensuing year: Chairman, Professor C. H. Cook, Western State College; Vice-Chairman, Professor B. W. Jones, University of Colorado; Secretary-Treasurer, Professor J. R. Britton, University of Colorado.

The program of papers for the Friday afternoon and Saturday morning sessions was as follows:

1. Sidelights on certain topics in elementary statistics, by Professor A. G.

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Clark, Colorado A. & M. College.

Various topics of the elementary course in statistics were discussed. These included bounds for the coefficient of correlation, the median as the value of M that minimizes $\sum_{i} |M-x_i|$, and the probit diagram method for fitting distribution curves to sample data.

2. Necessary and sufficient conditions on p and r that the equation $x^4 + px^2 + r = 0$ be normal over the rational field, by Mr. W. E. Briggs, University of Colorado.

Let t, -t, t', -t' be the roots of the irreducible equation $x^4 + px^2 + r = 0$, where t is an arbitrary root, and p and r are rational. The equation will be normal if R(t) = R(-t) = R(t') = R(-t'), where R(t) is the field of all numbers of the form $a_0 + a_1t + a_2t^2 + a_3t^3$ with the a_i rational. The necessary and sufficient condition is that t' be an element of R(t), or that $a_0 = a_2 = 0$, with $a_1 = p/\sqrt{r}$, $a_3 = 1/\sqrt{r}$, in which case the Galois group is the four group, or with $a_1 = (p^2 - 2r)/\sqrt{p^2 r - 4r^2}$, $a_3 = p/\sqrt{p^2 r - 4r^2}$, which gives the cyclic group of order four. This implies that either r or $p^2 r - 4r^2$ is a rational square.

3. Remarks on complex numbers and their functions, by Professor (Emeritus) A. J. Kempner, University of Colorado.

4. Generalized functional dependence, by Professor H. M. Jurney, Colorado School of Mines, introduced by Professor I. L. Hebel.

The functional dependence of n functions $u_i(x_1, \dots, x_m)$, $i=1, 2, \dots, n$, of m variables was discussed. The results may be expressed in the form of a theorem:

A relationship of the form $\phi(u_1, \dots, u_n) = 0$, exists for all values of x_1, \dots, x_m in some given domain of these variables if and only if the rank of the "Jacobian matrix" J_{mn} is less than n, where

 $J_{mn} = \begin{pmatrix} \partial u_1 / \partial x_1, \cdots, \partial u_1 / \partial x_m \\ \cdots \\ \partial u_n / \partial x_1, \cdots, \partial u_n / \partial x_m \end{pmatrix}.$

5. Periodic solutions of nonlinear differential equations, by Professor A. B. Farnell, University of Colorado.

A discussion was given of the use of fixed point theorems in proving the existence of periodic solutions of nonlinear differential equations, and, by way of illustration, the proof of the existence of such a solution for a particular equation was given.

6. On automorphs of conic sections, by Professor B. W. Jones, University of Colorado.

The linear transformations $x = \alpha x' + \beta y'$, $y = \gamma x' + \delta y'$, with $\alpha \delta - \beta \gamma = 1$ which leave invariant the quadratic form $x^2 + sy^2$, $s \neq 0$, were shown to satisfy the conditions $\alpha^2 + s\gamma^2 = 1$, $\alpha = \delta$, and, if $\alpha \neq 0$, $\beta = -s\gamma$. Hence β may be defined as the "conic cosine" of an angle θ and γ the "conic sine." If s = 1 we have the circular functions, if s = -1, the hyperbolic functions. It was shown that such transformations may be used to eliminate the xy term in the equation of any conic section.

7. The IBM card-programmed electronic calculator, by Mr. W. W. Varner, University of Colorado.

This illustrated presentation described the physical appearance and operation of the recently released semi-portable IBM card-programmed electronic calculator. A specific problem was presented and the details of programming introduced to illustrate the versatility of the machine as well as the technique of programming. A brief discussion of the arrangement of the calculation to mini-

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mize storage requirements was included to call attention to the critical problem of storage limitation.

8. Do you enjoy the problem sections in the Monthly? by Mr. Hans Stetter and Mr. Donald Tucker, Colorado A. & M. College, introduced by Professor M. L. Madison.

Representative problems selected from the advanced problems section of late issues of this MONTHLY were solved. The problems proposed in the MONTHLY can serve as a challenge to the undergraduate major in mathematics, and many of these problems can be solved by ingenious elementary devices.

9. A note on income tax calculations, by Professor W. K. Nelson, University of Colorado.

10. Occupational outlets in industrial and business fields for majors in mathematics, by Professor S. R. Smith, University of Wyoming.

In the unavoidable absence of Professor Smith, this paper was read by Professor Greta Neubauer.

11. Recent efforts and achievements in the revision of the high school mathematics program, and their significance in college, by Professor C. F. Barr, University of Wyoming.

Professor Barr presented a review of the content and grade placement of high school algebra and geometry. He then developed historically the opinions of well-known mathematicians and the various responses of mathematics teachers to these opinions. Two large resulting movements were described: one, the "two-track" movement in which algebra and geometry were taught to the superior pupils while a course with a utilitarian flavor was presented to those not capable of following the algebra-geometry track; the other movement being not the "two-track" one, but the socializing and popularizing of algebra and geometry, which were urged upon a majority, if not all, of the pupils. The objections to each of these programs were reviewed. The author proposed that a third program, consistent with the accepted purposes of mathematics, be considered, namely, the development of a course compiled from the everyday experiences of all normal citizens. This course he urged should be required of all pupils at some time in their high school program, regardless of their intellectual abilities, and that it be supplemented by algebra and geometry of the classical type if the student intended to pursue mathematics or if he expected to train in any technological field. The age level at which this course should be required was discussed briefly, with the observation that perhaps systematic experimentation alone would furnish any dependable answer.

The after-dinner address Friday evening was given by the guest speaker, Professor G. B. Price, University of Kansas. Professor Price gave an illustrated lecture on the topic, *Experiences of a Mathematician as an Operations Analyst* with the Eighth Air Force in England.

J. R. BRITTON, Secretary

THE APRIL MEETING OF THE IOWA SECTION

The Iowa Section of the Mathematical Association of America held its thirty-eighth annual meeting at Wartburg College, Waverly, Iowa, on Friday and Saturday, April 20–21, 1951. The Chairman, Professor D. L. Holl of the Iowa State College, presided at both sessions.