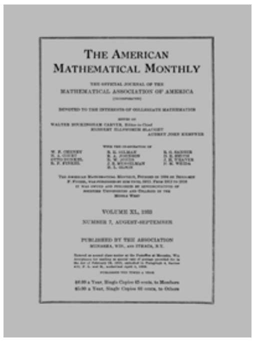
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The Tenth Meeting of the Indiana Section

P. D. Edwards (Secretary)

$$Y-\overline{Y}=\frac{\sigma_y^2-\sigma_x^2+\sqrt{(\sigma_y^2-\sigma_x^2)^2+4p^2}}{2p}(X-\overline{X}),$$

where $p=r\sigma_x\sigma_y=\sum(X_iY_i)/n-\overline{X}\overline{Y}$. The median regression line which makes the sum of the absolute values of the distances from the line a minimum is unsuitable because it is not always unique. If unique it usually passes through one or more of the original points with about the same number on either side. By holding one point fixed one may easily estimate by using horizontal distances whether rotation to right or left will diminish the sum of the perpendicular distances. Weighted points count as multiple points. However, this line does not fit in so well with ordinary probability theory as the absolute regression line defined above.

4. The purpose of Mr. Thompson's paper was to present parametric solutions of two very general Diophantine equations,

$$X_1^2+X_2^2+X_3^2+\cdots+X_p^2=W^n$$

and

$$X_1^2+a_1X_2^2+a_2X_3^2+\cdots+a_{p-1}X_p^2=Y_1^2+b_1Y_2^2+b_2Y_3^2+\cdots+b_{n-1}Y_n^2.$$

The solutions were obtained directly from the stated problem in terms of independent parameters, thus obtaining multiple infinitudes of solutions, according to the number of parameters involved.

6. This is a field formed by taking one-rowed matrices of three elements each with multiplication $\cdot$, and addition $+$, defined as follows: $(a, b, c)+(x, y, z)=(az+2by+cx, bz+cy, cz)$; and $(a, b, c)\cdot(x, y, z)=(ax, by, cz)$; $(a, b, c)=(x, y, z)$, if $x/a=y/b=z/c$.

7. Professor Earl's paper considers the approximation to a given function of two variables by means of a sequence of polynomials which are determined so as to minimize the integral over an unbounded region of the product of a non-negative weight function and the mth power of the magnitude of the error.

A. L. Hill, *Secretary*

THE TENTH MEETING OF THE INDIANA SECTION

The tenth meeting of the Indiana Section of the Mathematical Association of America was held Friday and Saturday, May 5 and 6, 1933, at Indiana University, Bloomington, Indiana.

There were forty-two registered for the meetings on Saturday including the following twenty-one members of the Association:

Gladys L. Banes, H. T. Davis, W. E. Edington, P. D. Edwards, E. D. Grant, E. H. C. Hildebrandt, F. H. Hodge, E. L. Klinger, Mayme I. Logsdon, Florence Long, Juna M. Lutz, H. A. Meyer, T. W. Moore, J. A. Reising, C. K. Robbins, Fred Robertson, D. A. Rothrock, L. S. Shively, H. E. Slaught, R. O. Virts, K. P. Williams.

On Friday evening an informal reception was held in the East Parlors of the Student Building for arriving members and their guests. At six o'clock a dinner was held in the Grill room of the Indiana Union Building. Professor K. P. Williams acted as toastmaster. Short talks were given by Professor Fernandus Payne, Dean of the Graduate School and head of the department of zoology, and by Professor H. E. Slaught of the University of Chicago. At eight o'clock Professor Slaught gave a public lecture on the subject: "The lag of mathematics behind literature and art in the early centuries." This lecture was later given on the program of the national meeting of the Mathematical Association of America held in Chicago in June and an account of it will appear in the report of that meeting.

The meeting on Saturday was presided over by Professor K. P. Williams of Indiana University, chairman of the Section. At the business meeting the following officers were elected: Chairman, Professor Juna M. Lutz, Butler University; Vice-Chairman, R. O. Virts, Central High School, Fort Wayne; Secretary-Treasurer, Professor P. D. Edwards, Ball State Teachers College.

The retiring chairman's address was given by Professor Williams on the subject, "Early theories of comet orbits." Professor Williams presented the important phases of the early theories and gave especial attention to the very great difficulties involved in the calculation of orbits. Many of the solutions by first rate mathematicians have been all but useless to the practical astronomer because of the extreme difficulty of carrying out the necessary calculations.

The following papers were presented:

1. "Dynamic symmetry" by Professor S. A. Cain, Department of Botany, Indiana University, by invitation.
2. "The Mathematical Association and a decade of mathematics in Indiana" by Professor W. E. Edington, De Pauw University.
3. "Concerning modular functions" by Professor W. E. Maier, Purdue University, by invitation.
4. "Some elementary formulas suggested by an elementary equation in trigonometry" by Professor F. H. Hodge, Purdue University.
5. "The expansion of an arbitrary operative function in successive derivatives" by Professor Fred Robertson, Iowa State College.
6. "Polar line coordinates" by Professor C. K. Robbins, Purdue University.
7. "Some applications of periodogram analysis" by P. W. Overman, Indiana University, by invitation.

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

1. The term "dynamic symmetry" was coined by Professor Jay Hambidge to describe some of the relationships he discovered in Greek art of the Classical Period. His later researches led to its discovery in ancient Greek writings. It had failed of translation because moderns had no concept of the meaning until Hambidge had developed it, by an analysis of art objects, as a system of pro-

portion probably used consciously by the Greeks in the construction of art and architectural objects. The underlying theme is that of root-rectangular areas and a peculiar area, the whirling-square rectangle, which are manipulated so as to form *commensurate areas* and gnomens by diagonals and perpendiculars—the construction being such as largely to control the "idea" of the art object as to form, and, to a certain extent, ornament. The end and side of the whirling-square rectangle are as 1 to 1.618. This has been called the ϕ ratio and is found in many diversified phenomena. The root rectangles have 1 as their end and $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, as their sides.

The Greeks probably got the proportions from the ancient Egyptians as the ϕ ratio has been found in the pyramids dating back as far as 4700 B.C. The ϕ ratio rectangle and its reciprocal equal the root-five rectangle, both of which, along with the other root-rectangles, could have been obtained from a square by at least two simple methods of construction used by Egyptians in the "cording of the temple." Why these proportions are "good" in art it is difficult to say, but many modern artists and craftsmen have found it profitable to employ the methods in manipulation of their ideas for designs.

It is truly a remarkable phenomenon that the ϕ ratio should be found as a fundamental underlying theme in the architecture of plants, especially in phyllotaxy, the arrangement of leaves on the stem. Most leaves are arranged in a spiral system the relations of which form a numerical series known as the Fibonacci summation series, running 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, the ratio of which converges on 1.618, the ϕ ratio. This series has been known for centuries but the explanation has only recently been found by A. H. Church of Oxford in continued proportionate growth of leaf primoidia arranged in curve systems on a conic-ovoid growing point. The ubiquitous spiral in nature has been the subject of many interesting speculations and studies and is frequently logarithmic in nature, due in the main to growth phenomena.

The ϕ ratio is also that of Euclid's proposition, to cut a line in extreme and mean proportion, the so-called Golden Section. There have been many formulae of beauty, perfect figures and more or less mystical obsessions held by philosophers of the past and almost any good art will permit of analysis leading to formulae and approaching scientific exactness, but that is certainly neither the whole explanation nor the sole need for creative work. That the ϕ ratio should have been used by the ancient Egyptians and the classical Greeks in the production of good art, constitute the Golden Section, be inherent in the root-five rectangle and other geometrical figures, and constitute one of the most wide spread of botanical phenomena is without any correlating explanation.

2. The history of the Mathematical Monthly and the problems of its publication were sketched briefly in order to show how the problem of its continuation led up to the conception and organization of the Mathematical Association through the combined efforts of the founder of the Monthly, B. F. Finkel, and the three active organizers, H. E. Slaught, E. R. Hedrick and W. D. Cairns. Some original correspondence concerning the charter membership was shown.

The Indiana Section of the Association was reorganized on an active basis on October 16, 1924, at Indianapolis, and has since met regularly in the spring at the various universities and colleges over the state. The programs have always included addresses by speakers of note among whom have been Jacques Hadamard, of Paris, F. R. Moulton, Jacob Kunz, D. W. Moorehouse, Warren Weaver, L. C. Karpinski, T. C. Fry, G. A. Bliss, Cornelius Lanczos, and H. E. Slaught.

The membership of the Section has increased from 30, in 1916, to 65 according to the last directory. A total of 20 research papers by members of the Section have been published in reputable mathematical journals during the past decade. The interest aroused by the meetings of the Section has led to the formation of several undergraduate mathematical clubs in the colleges of Indiana. The advances made in recent years in the development of graduate study in the state was pointed out and the fact that six Ph.D. degrees with mathematics as a major were conferred in the state during the past four years was presented as evidence of general quickening in mathematical interest no little part of which may be attributed to the work of the Indiana Section of the Association.

3. Let $0<F(\omega)$ and $e^{\pi i\omega}=q$. The classical identity

$$\left(\sum_{v=-\infty}^{\infty} q^{v^2}\right)^2 = 2\sum_{n=-\infty}^{\infty}\frac{q^n}{1+q^{2n}}$$

was proved in a new way due to the fact that, generally,

$$\begin{aligned}&\lim_{l\to\infty}\sum_{0<h^2+k^2<l}\frac{(-1)^h}{2h+1+2k\omega}\\ &=\lim_{l\to\infty}\sum_{0<h^2+k^2<l}\frac{(-1)^k}{2h+(2k+1)\omega}\cdot\begin{cases} i & \\ -i, & \end{cases} if \begin{cases}0<F(\omega)\\ 0>F(\omega).\end{cases}\end{aligned}$$

4. Starting with the identity $\cos 20^\circ \cos 40^\circ \cos 80^\circ = 1/8$ this paper gives several methods of proving this identity with several general formulas together with proofs suggested by the methods of proof for the original identity.

5. The problem is the determination of a method of expanding an arbitrary operative function $f(x, z)$ in a series of successive powers of z. The symbol z shall be interpreted to mean the operational derivative d/dx and its powers the corresponding successive derivatives.

The components z^i define the function $f(x, z)$. These component functions are grouped according to the formula of Schmidt for the discovery of a normalized orthogonal system of functions by linear combinations of the given set.

The function is then expanded in the Fourier manner in terms of these functions $\phi_i^{(z)}$ for the range $0<z\leq 1$ of the independent variable. The resulting series is then rearranged in terms of the successive powers of z.

The expansion is stated thus,

$$f(x, z) = \sum_{n=1}^{\infty} A_n(x) \sum_{i=1}^{n} \sum_{\alpha} (-1)^{\beta+i+1} \frac{1}{N_{n\ldots\beta\ldots i}} z^i$$

where

$$A_n(x) = \int_0^1 f(x, z)\phi_i(z)dz$$

and α is every possible combination of $(n-1) \cdots (i+1)$ in the order given, β is the number of indices omitted, $(\beta=0, 1, \cdots, n-i-1)$ and $1/N_i$ is the reciprocal of the square root of the norm if the index is not repeated but is the product of these expressions by $\int_0^1 \phi_i(z)z^i dz$ when the index is repeated.

6. The ordinary polar coordinates of a point also determine a line perpendicular to the radius vector at its end point and may, therefore, be thought of as the coordinates of this line.

To find the polar line coordinate equation of any curve, express its pedal curve in polar coordinates. This type of coordinates proved to be extremely cumbersome in practise but some of the by products turned out to be both new and interesting. For example, if, to three lines through a point perpendiculars of lengths a, c and b are dropped from another point then $c \sin(A+B) = a \sin A + b \sin B$ where A is the angle between b and c, and B the angle between a and c.

7. In this paper the theory of the Schuster periodogram was developed. Applications were shown to such divergent subjects as sun-spots, weather changes, market fluctuations, recurrence of earthquakes, stellar variations, magnetic disturbances, etc. The speaker announced the completion of an elaborate set of tables for the computation of periodograms. Values of $\sin\theta$ and $\cos\theta$, $\theta = 2\pi s/u$, have been computed to 8 decimal places for s from 0 to u, and u from 5 to 75 by integers.

At the afternoon session of the Section a resolution was adopted expressing the appreciation of the members of the Section for the hospitality and courtesy extended to them by the members of the mathematics department of Indiana University.

P. D. EDWARDS, *Secretary*

THE MAY MEETING OF THE MARYLAND—DISTRICT OF COLUMBIA—VIRGINIA SECTION

The May meeting of the Maryland—District of Columbia—Virginia Section of the Mathematical Association of America was held at the University of Virginia on Saturday, May 13, 1933.

Sixty-three persons attended the meeting including the following forty-two members of the Association: O. S. Adams, M. W. Aylor, Archie Blake, J. W. Blincoe, W. E. Byrne, Paul Capron, Orpha A. Culmer, Tobias Dantzig, Alexander Dillingham, J. A. Duerksen, W. H. Echols, Mary Ewin, P. J. Federico,