

# PI MU EPSILON JOURNAL

THE OFFICIAL PUBLICATION OF  
THE HONORARY MATHEMATICAL FRATERNITY



VOLUME 1

NUMBER 7

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NOVEMBER

1952

PI MU EPSILON JOURNAL  
THE OFFICIAL PUBLICATION  
OF THE HONORARY MATHEMATICAL FRATERNITY

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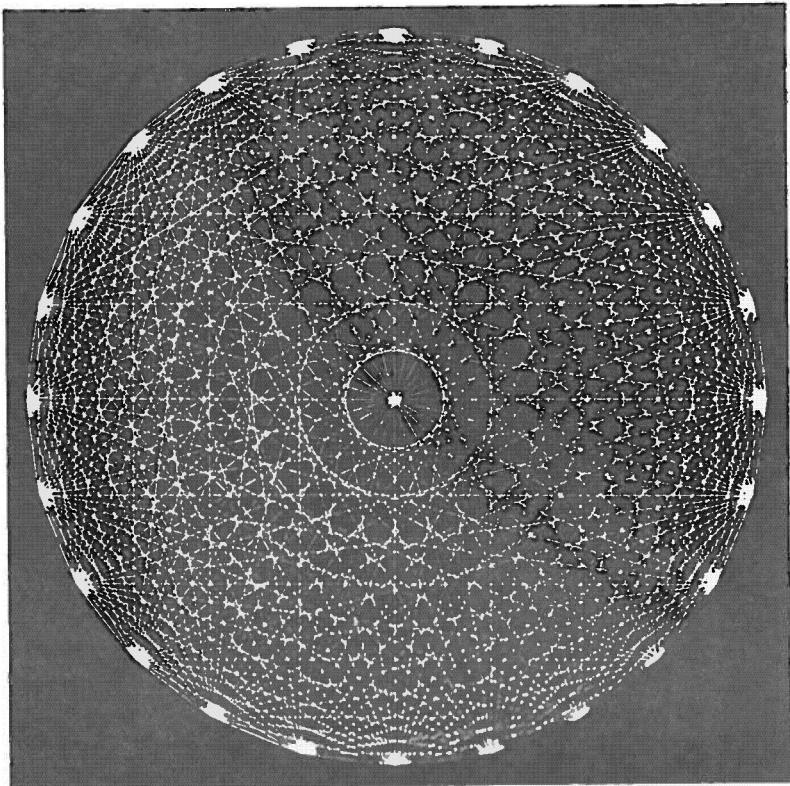
1952

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**Dynamic Beauty of Geometrical Forms**

\*

*By Hermann Baravalle*



The above design is obtained by drawing all the diagonals  
of a regular polygon of 24 sides.

\*Courtesy of **SCRIPTA MATHEMATICA**.

**SO YOU WANT TO BE A GRADUATE STUDENT?\***  
**C. C. MacDuffee**, University of Wisconsin

A graduate student has been defined as a moron wandering around the campus who doesn't know the show is over. He is miles apart from the undergraduate. His social position in an institution such as Harvard or Princeton is absolutely nil. The genuine alumni who have carried the football team to victory with their raucous voices become mildly indignant with a person who claims to be an alumnus merely on the basis of an advanced degree.

The graduate student rarely has any money. Both graduate and undergraduate dress like Raggedy Andy, the undergraduate because it is the style, the graduate because he has nothing better. As a rule the graduate student does not belong to a fraternity, or if he does he conceals his membership to save money and to avoid having to chaperone dances. He cannot afford the Roman festivals in the stadium or the more expensive musicales in the university theatre. He lives a Spartan existence with his books, or like the little **Chinaman** the school boys in New **York** sing about,

sittin' on a fence  
Tryin' to make a quarter out of fifteen cents.

The graduate student is apt to be married. Probably his wife works and supports them both. (This, by the way, is a suggestion to you men who can't think of a way to finance yourself through Graduate School.) Or else they have three

---

\*An address presented before the Pi Mu Epsilon Fraternity at the beginning of the scientific session, Monday morning, September 1, during the National Meeting held at Michigan State College, East Lansing, Michigan, August 31 and September 1, 1952.

children and live in a trailer or temporary housing unit surrounded by clothes lines, baby pens and pandemonium.

To the undergraduate these graduate students are a phenomenon to accept but not to understand. They are strange people who actually like to study. They are going to be teachers, for the most part, and that of course marks them for what they are. Teachers never make any money. Only screw-balls become teachers, instead of respectable stock brokers or realtors who make money and play golf and use personality instead of brains.

In fact, when you think about it, it is a wonder that anyone becomes a graduate student. And yet there are thousands of new ones every year. They go into every field of human endeavor. There are even a few hundred who go into that most impossible of all subjects, mathematics. Even graduate students in the socially significant subjects think the mathematicians are queer. They think they spend all their time learning to add up columns of figures very rapidly. "and, my dear, they have machines now-a-days that can do it ever so much more quickly."

These people can never understand the appeal that mathematics has for a few selected individuals. If they do not feel it, it is useless to try to explain it to them, so let's not waste our time. If you do have this feeling toward mathematics, it is a waste of my time to tell you what your feelings are. If you are a genuine devotee you will pursue mathematics regardless of the trials and tribulations through which your pursuit will lead you. All my attempts to dissuade you from becoming a graduate student will be of no avail.

My only serious word of warning, however, is that you should be sure that you are a genuine devotee before you become immersed. Don't think of entering graduate school without a good background of undergraduate mathematics. This should include a year of elementary calculus and all the work preparatory to the calculus, and five or six semesters beyond the calculus. These courses should be diversified to include a little analysis, a little algebra and probably a little geometry or applied mathematics. A course or two in physics is desirable, and of course no other information that you may happen to pick up will do you any serious injury.

Among the subjects most commonly presented as part of the undergraduate major are a year of advanced calculus, a semester each of differential equations, theory of equations, solid analytic geometry, college geometry, vector analysis and statistics. A large number of other courses are readily acceptable such as complex variable, determinants and matrices, theory of numbers, projective geometry, analytic mechanics, probability, etc. But at this stage the student would do well to get a broad foundation, and not try to take graduate courses before he is ready for them.

Beware of courses in the teaching of mathematics. You will probably be shocked to find that these courses will not be accepted by the Graduate School as counting among the post calculus courses required for entrance. Of course the situation may be different if your graduate work is to be in Education. I am considering only those who wish a degree in pure or applied mathematics.

Probably every graduate school receives many applications for admission from enthusiastic young mathematicians who have had little beyond the calculus. Regardless of their abilities, these students are at a disadvantage in competition for scholarships or other aid, and in fact do not yet know if they really like mathematics or can do it. The work for the master's degree is prolonged to three semesters or two years. It would seem to be more economical for the student to get all the mathematics he can while still an undergraduate. Even if he comes from a school so small that five mathematics courses beyond the calculus are not given, he can usually arrange to do honors reading in his senior year.

Do not forget that mathematics is an international subject. Particularly if you expect to go beyond the master's degree, you must know your foreign languages. The most important of these are French and German, and some universities such as Wisconsin expressly stipulate these two foreign languages. Some universities give a limited choice. But the popular easy language of our high schools, namely Spanish, is generally not acceptable for the simple reason that Spanish-speaking nations have not been important in the development of mathematics and there is no large Spanish mathematical literature. I cannot impress upon you

too strongly the advisability of taking two years, or if this is impossible at least one year, of each of the two languages French and German while you are still an undergraduate.

In spite of your enthusiasm, you will probably not make a successful graduate student unless you have had high grades as an undergraduate. Your grades in mathematics beyond the calculus should be at least half A's, and your general over-all averages as an undergraduate should be B or above. Some graduate schools will admit you with a slightly lower average, but the competition will make you unhappy. We sometimes have applicants whose records contain only A's for four years straight and, the Sunday newspapers and popular misconceptions to the contrary notwithstanding, these persons invariably are highly successful in later life.

Let us suppose, then, that you have an overpowering enthusiasm for mathematics, have majored in it as an undergraduate, and have been at the top of your class in this subject and close to the top in all subjects. The chances are favorable that you will be accepted by some good graduate school and that in a year or so more you will achieve the coveted M. A. or M. S. degree.

Almost every application for admission that we receive begins in the same way: "I want to take graduate work in mathematics but I have no money and will not be able to come unless I am given a scholarship or a teaching assistantship." One boy last year calmly stated that it would cost us a cool \$3000, if we wished to be graced with his presence. I suppose there are graduate students with a little money, just as there are wealthy undergraduates, but we don't seem to get many of them at Wisconsin. I suspect that in many cases parents think the show should be over and refuse to cooperate further.

Fortunately all of the graduate schools do have funds available for the subsidization of graduate students. These vary from a simple remission of tuition to half-time teaching positions. Some require service on the part of the recipient, some do not. A student with no entrance deficiencies and a very high undergraduate record can usually do quite well by himself. Renewal of scholarships depends of course upon success in the graduate school.

If you wish to enter a graduate school next September, you should begin operations the moment your grades for the first semester are in. Consult your favorite mathematics professor and ask his advice regarding graduate schools. Select three or four that appeal to you and write to the dean of the graduate school for information and instructions. Or you may make your first contact by writing to the chairman of the department of mathematics.

By general agreement among the universities, your application for a scholarship, together with a transcript of your grades to date and supporting letters from three or four of your professors should be filed by the middle of February. On the first of April or thereabouts you will be notified of your awards. You will make your choice (not entirely, it is to be hoped, on a monetary basis) and notify each university of your decision.

Appointments to teaching assistantships are usually made by department chairmen and can be made at any time, even up to the middle of September if vacancies occur.

A student is sometimes confronted with the dilemma whether he should accept a scholarship which does not pay much but requires no services, or a teaching assistantship which pays a little more but limits him to two-thirds residence credit. The answer depends upon other considerations. If you expect to be in graduate school more than one year, probably you should take the scholarship the first year. However, unless you are already an experienced teacher you should arrange to do a little teaching sometime before you leave if you wish to be recommended for a teaching position.

When you enter graduate school you are no longer an amateur mathematician, you have turned professional. Your classmates will have come from every section of the United States and perhaps from foreign countries as well. Each one was the joy and pride of some college. Many will have had more experience than you have had, and everybody will be as competitive as a race horse. Probably you will have to relinquish your habit of being at the top of your class and it will take your best efforts just to keep up. You will have to do more than just the daily assignments. You will have to

diagnose your own weaknesses and spend much time in the library stopping them up. But you will learn mathematics at a rate that you have never learned it before.

You will find your fellow students a really wonderful lot. For the first time in your career you will associate almost exclusively with your mental equals, people who think as you do and who will understand what you are trying to express. They will have the same ideas and ideals as yourself, and although you will have furious arguments with them, these will be genuine debates in which fact will be met with fact. You will make friends with people who will afterwards become famous, and you will have acquaintances in almost every state of the Union. The graduate students of today are the persons who will carry the torch of civilization in the years to come.

To what does all this effort lead? It rarely leads to riches. But it usually leads to a comfortable and highly respectable living, and in these days that is not to be scorned. A **master's** degree in mathematics opens the door to a teaching position in a small college whether or not you have had Education with the big E. If you are a qualified high school teacher and have the master's degree in addition, you are in a position to be a departmental head in a large city high school. In New York City many departmental heads have the doctorate in the subject that they teach, but I do not think that many cities have such high standards.

American industry is rapidly becoming mathematically conscious. In the last few years we have placed as many graduates, both masters and doctors, in industry or Government service as in teaching positions. Such positions are so diversified that I will make no attempt to describe them. It is not necessary that you be a specialist in applied mathematics to qualify for an industrial position. Pure mathematicians are in great demand, for it is the insight which they bring to a problem that is important; and regardless of what psychologists say at the moment, there is a transfer of training. Today it is hard to say which branches of mathematics are pure and which are **applied**. A pure mathematician often has a fresh viewpoint on an old problem. Some of the finest work in applied mathematics in connection with

the last war was done by pure mathematicians without previous applied experience.

The giant computing machines have opened up a new era in mathematics by making it possible to attack problems which were formerly impossibly tedious. But the machines have their own limitations which differ from those of the human mind so that many mathematics courses must be entirely rewritten for the calculator. The machine operator is not a garage mechanic, he must be a highly skilled and specialized mathematician. The demand for competent operators of electronic computing machines is now greater than the supply so that at the moment such a person is able to command an excellent salary.

I have refrained from giving any advice regarding subjects to be studied in graduate school for this would be trespassing on private ground. But perhaps I may speak in generalities. Until a student is sure of his own abilities in graduate competition, he had best not take too many subjects nor too advanced ones. I have seen graduate students ruined by their desire to jump too quickly into advanced subjects. I have seen some of these same demoralized students transfer to another university, start over, and become excellent mathematicians. But the experience is not good for one's soul and it should be avoided.

The **master's** degree conventionally stands for a broad unspecialized training in the principal fields of mathematics, analysis, algebra and geometry or topology. The doctorate represents research ability, a high order of scholarship, and specialized training in some narrow field.

I have not said much about the doctor's degree. Ideally one should wait until after one has the **master's** degree before even thinking about the doctorate. But humans are not like this, and almost every graduate student cherishes an outspoken or secret intention to become a doctor. Some succeed and some find that the God-given fire of originality was not vouchsafed to them. But regardless of whether one is completely or partially successful, a year in a graduate school is an experience of deep significance, after which one can scarcely be immature or superficial in his thinking no matter what paths he may tread in later life.

REPORT OF THE NATIONAL MEETING  
OF THE PI MU EPSILON FRATERNITY  
East Lansing, Michigan

A national program meeting of the PI MU EPSILON fraternity was held in the Physics-Mathematics Building at Michigan State College, East Lansing, on Monday, September 1, 1952, preceded by an informal discussion meeting for delegates and a meeting of the National Council on Sunday evening, August 31.

Twenty-two of the fifty-one active chapters were represented by the following members either at the Sunday evening meeting or the Monday morning business meeting, or both:

Alabama Alpha (University of Alabama) — Betty Ellis\*  
 California Beta (University of California) — R. M. Lakness,  
     K. O. May (now at Carleton College)  
 Delaware Alpha (University of Delaware) — Verna Lair \*\*  
 Georgia Alpha (University of Georgia) — Bevan K. Youse,  
     L. A. Nix, Jr.  
 Illinois Beta (Northwestern University) — F. P. Peterson\*  
 Iowa Alpha (Iowa State College) — C. Gouwens  
 Kentucky Alpha (University of Kentucky) — W. M. Zaring\*\*  
 Michigan Alpha (Michigan State College) — J. S. Frame, W.  
     G. Franzen, G. W. Hess, Mary Ann Hutchinson, Robert  
     Jones, L. M. Kelly, H. S. Leonard, Jr., \*\* C. D. Parker,\*\*  
     Mary H. Payne, W. A. Reid  
 Missouri Gamma (St. Louis University) — W. J. Huebner\*  
 New York Alpha (Syracuse University) — Ruth King, Ruth  
     Stokes  
 New York Beta (Hunter College) — J. Hobart Bushey, Jewell  
     H. Bushey

\*Student delegate who received part transportation expense.

\*\*Student speaker.

New York Gamma (Brooklyn College) — A. J. Goldman\*\*  
 New York Eta (University of Buffalo) — Edith Schnecken-  
     berger

North Carolina Beta (University of North Carolina) — W. M.  
     Whyburn

Ohio Gamma (University of Toledo) — Grace Cutler, Violet  
     Davis

Oklahoma Alpha (University of Oklahoma) — R. V. Andree,  
     R. B. Deal, Jr., John E. Hoffman.\*\* C. E. Springer \*

Oklahoma Beta (Oklahoma A. and M.) — Gene Marshall, \* J.  
     H. Zant

Pennsylvania Beta (Bucknell University) — William L. Wolfe \*

Pennsylvania Gamma (Lehigh University) — G. E. Raynor

Pennsylvania Delta (Penn. State College) — H. L. Black

Wisconsin Alpha (Marquette University) — H. P. Pettit

Wisconsin Beta (University of Wisconsin) — C. C. MacDuffee

Discussion at the Sunday evening meeting (attended by 28 members) centered around the problems and interests of local chapters. Refreshments were served by members of Michigan Alpha, and delegates had a chance to become acquainted with each other.

The National Officers (MacDuffee, Whyburn, Frame, and Stokes) and Professors R. M. Lakness and Edith Schneckenberger (who substituted for other members of the National Council) left the discussion about 9:30 p.m. to attend a business meeting of the National Council which lasted until midnight. Actions taken by the council included the following:

1. The petition of the Mathematics Club of the Alabama Polytechnic Institute for a charter for a chapter of Pi Mu Epsilon was discussed, approved, and referred to the chapters.

2. It was decided that a 50 cent fee should be charged in the future for issuing a duplicate certificate to correct a mistake in spelling on the order blank.

3. The Secretary General reported that Pi Mu Epsilon had initiated 20,775 members to date, including 1918 since April 1, 1951.

4. The Treasurer reported a cash balance of \$5368.81

on hand in the national treasury as of June 30, 1952, from which an estimated \$500 will be disbursed to pay travel allowances for delegates and other expenses of the national meeting.

5. It was suggested that the next national meeting be held in December 1953.

Following the Monday luncheon in the Phillips Hall Lower Dining Room there was a business meeting at which Director General MacDuffee presided. Actions of the National Council (described above) were reported to the delegates. Dr. Ruth Stokes, Editor of the PI MU EPSILON JOURNAL, reported on problems and plans for the journal. She urged the six student speakers at this meeting to submit their papers to her for publication.

These six student papers, supplemented by an address by Director General MacDuffee and a round table discussion on club programs, were the unusual feature of this national meeting, and were of much higher caliber than one might have expected from relatively inexperienced speakers. They were attended by 40 to 50 persons, many of whom stayed on later for the programs of the Mathematical Association of America, and the American Mathematical Society that were scheduled from September 1-5.

The formal program appears on the following page.

J. Sutherland Frame  
Secretary - Treasurer General

## 1952 REPORT OF THE NATIONAL MEETING

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### PROGRAM

Sunday, August 31, 1952

#### EVENING

Room 221, Physics-Mathematics Building

- 8:00** Informal discussion meeting about programs for local chapter meetings to serve as a basis for the round table discussion Monday morning.

Room 206, Physics-Mathematics Building

- 9:00** National Council Meeting: C. C. MacDuffee, W. M. Whyburn, J. S. Frame, (S. S. Cairns), (Tomlinson Fort), (Sophie MacDonald), Ruth W. Stokes, (H. C. Bennett). R. M. Lakness, Edith Schneckenberger.

Monday, September 1, 1952

#### MORNING

Room 118, Physics-Mathematics Building

- 9:00** **So You Want to Be a Graduate Student**  
DIRECTOR GENERAL C. C. MacDUFFEE, Wisconsin Beta.

- 9:30** **Modification of Infinite Series.**  
BEVAN K. YOUSE, Georgia Alpha.

- 10:00** **Rapid Square Roots.**  
CHARLES D. PARKER, Michigan Alpha.

**10:30** INTERMISSION

- 10:40** **Almost Periodic Functions.**  
JOHN E. HOFFMAN, Oklahoma Alpha.

- 11:10** Round Table discussion on programs and activities of local chapters.

#### NOON

Lower Dining Room, Phillips Hall

- 12:15** Lunch and Business Meeting.

#### AFTERNOON

Room 118, Physics-Mathematics Building

- 2:00-5:00** Sessions of the Mathematical Association of America.

#### EVENING

Room 118, Physics-Mathematics Building

- 7:00** **Matrix Inversion.**  
VERNA LAIR, Delaware Alpha.

- 8:00** **Metric Extension.**  
ALAN J. GOLDMAN, New York Gamma.

- 8:30** **The G. C. D. Algorithm.**  
WILSON M. ZARING, Kentucky Alpha.

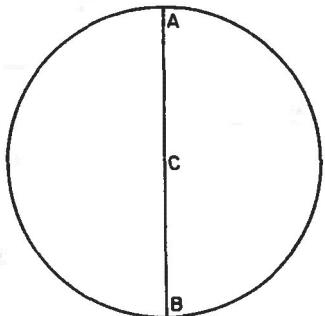
Room 221, Physics-Mathematics Building

- 9:00** Coffee Hour.

AREA IN WHICH A NARROW ROD  
CAN BE REVERSED IN DIRECTION

Robert E. Greenwood,  
The University of Texas

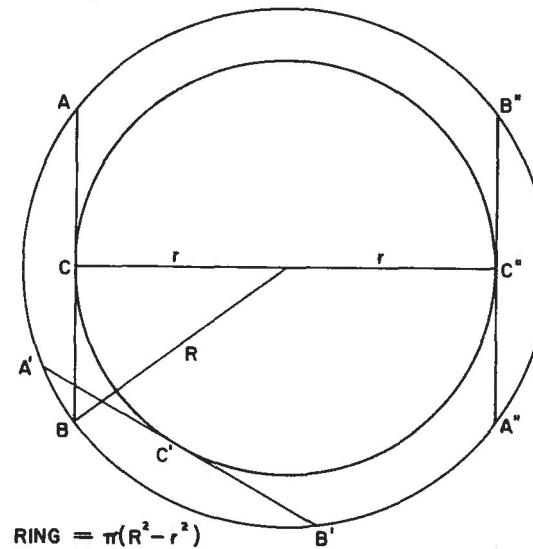
How much area is needed for a ship to turn itself around in? Let us replace the ship with bow A and stern B by a thin rod of length  $k$  with midpoint C. Then the interior of a circle of diameter  $k$  with C as center is a possible area in which the "ship" may be turned around in. See Figure 1. The area is  $\pi k^2/4$ .



$$\text{CIRCULAR AREA} = \frac{\pi k^2}{4}$$

$$\text{RADIUS of CIRCLE} = \frac{k}{2}$$

FIGURE 1



$$\text{AREA OF ANNULAR RING} = \pi(R^2 - r^2)$$

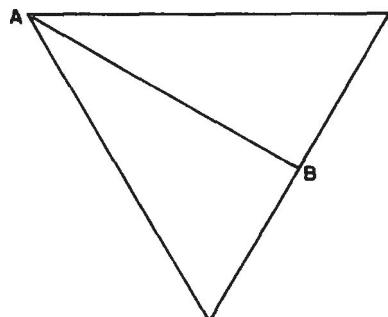
$$= \frac{\pi k^2}{4}$$

FIGURE 2

Are there smaller areas? If we are not interested in the final position in the plane in which our reversed ship is located, we may consider the area between two concentric circles of radii  $r$  and  $R$ ,  $r < R$ , where  $R$  is so chosen that when the midpoint C of the ship is tangent to the small circle, the two ends A and B will fall on the large circle. An immediate consequence is that  $R^2 - r^2 = k^2/4$ . Furthermore, from Figure 2, the area of the ring may be readily computed, area of annular ring =  $\pi(R^2 - r^2) = \pi k^2/4$ . If the ship be moved from position ACB through A'C'B' to position A''B''C'', we see that the area ACC''B'' (in the upper part of Figure 2) is not used at all in the reversing process. Intuitively, we feel that as  $r$  gets larger and larger the area ACC''B'' approaches half the area of the annular ring, and hence we feel that we need only half the area of the ring to reverse the ship. Notice, however, that as  $r$  gets larger, the distance CC'' also gets larger, so that the reversed

ship gets farther and farther away from its original position. We conclude that the limiting area required for reversal is area =  $\pi k^2/8$ .

By considering an equilateral triangle of altitude  $k$  (and hence side  $2k/\sqrt{3}$ ), we may effect quite a saving in the area as compared to the circular case of Figure 1. See Figure 3. Since the area inside the triangle is  $k^2/\sqrt{3}$ ,  $1/\sqrt{3} \approx 0.577$ ,  $\pi/4 \approx 0.785$ , there is a saving in area.

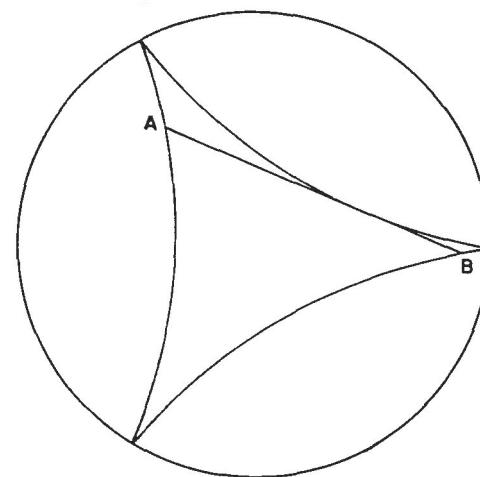


$$\text{AREA INSIDE TRIANGLE} = \frac{k^2}{\sqrt{3}}$$

$$\text{ALTITUDE of TRIANGLE} = k$$

FIGURE 3

If you have mentally performed the reversal process described for the triangular area of Figure 3, you may have recognized that there is too much free "play" in the position of the ship. A more efficient utilization would require some conditions like those in Figures 1 and 2, i.e., it must not be possible to place the rod **AB** in the area unless both ends A and B are on the boundary of the area. Such a condition is not satisfied for Figure 3.



$$\text{AREA INSIDE DELTOID} = \frac{\pi k^2}{8}$$

$$\text{AREA of CIRCLE} = (\frac{3}{4} k)^2 \pi$$

FIGURE 4

Another area somewhat triangular in appearance is given by the interior of the deltoid, or three-cusped hypocycloid, a curve first studied by Euler in 1745. The equation of the deltoid is more neatly expressed in parametric form

$$x = \frac{k}{4} (2 \cos t + \cos 2t),$$

$$y = \frac{k}{4} (2 \sin t - \sin 2t),$$

than in (x,y) notation with the parameter t eliminated:

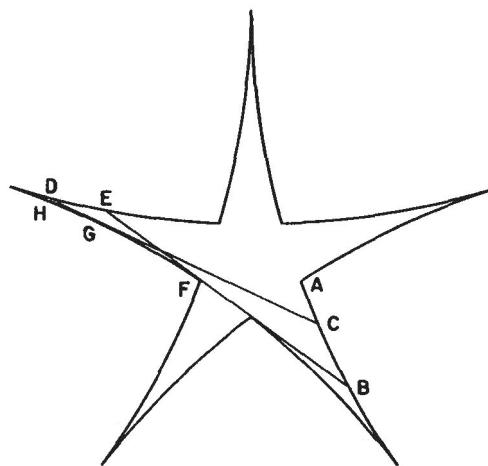
$$(x^2 + y^2)^2 - 2k x^3 + 6kxy^2 + \frac{18k^2}{16} (x^2 + y^2) = \frac{27k^4}{256}.$$

See Figure 4. The area inside the deltoid is sufficient to turn the ship around in. The area is "efficiently" used, for a tangent to any of three arcs at any position along that arc

has length  $k$  inside the deltoid area. Since the area is  $\pi k^2/8$ , this is just the limit of the half ring area of Figure 2, except that the final position of the ship is the same (except for reversal) as the original position.

For an interesting description of the deltoid and a discussion of its properties see Robert C. Yates, CURVES AND THEIR PROPERTIES, 1947, AM Arbor, Michigan, pages 71-74.

Since we have reduced the area to half the area of the circle of diameter  $k$ , the question as to whether or not we can go still further becomes important. The Japanese mathematician, Kakeya, conjectured in 1917 that the deltoid area represented a least area. However, Besicovitch in 1928 showed that there was no least area. A reference to **Besicovitch's** paper may be found in Professor **Yates'** book - the argument showing that smaller and smaller areas may be found in which it is possible to turn the ship around in, is outside the scope of this note.



$$\text{AREA} = .30k^2$$

FIGURE 5

#### ADDENDUM TO MR. GREENWOOD'S PAPER

R. J. Walker, **Cornell** University

Once one knows that the deltoid is not the smallest area within which one can reverse a "ship" one naturally asks for a sample of a smaller area. The Besicovitch proof, which makes use of a shuttling of the ship over long **distances** but with relatively small amounts of turning, **suggests** how this can be done, and Figure 5 shows an "efficient" area obtained by this process.

The figure is based on a regular five-pointed star. The arc  $AB$  is more or less arbitrary (as long as the curvature is small enough); in this figure it is an arc of a circle tangent to a side and to a bisector of an angle of the star. The length  $k$  of the ship is then determined as  $BE$ . As the ship moves, staying tangent to arc  $FG$  and keeping one end on arc  $AB$ , the other end describes arc  $ED$ . By symmetry we get arc  $GH$  for the point of tangency to move along. Evidently a continuation of this process enables us to construct the entire figure.

The area of this figure comes out to be about  $.30k^2$ , considerably less than the  $.392k^2$  given by the deltoid.

PROBLEM DEPARTMENT  
Edited by  
Leo Moser, University of Alberta

This department welcomes problems believed to be new and, as a rule, demanding no greater ability in problem solving than that of the average member of the Fraternity, but occasionally we shall publish problems that should challenge the ability of the advanced undergraduate and/or candidate for the Master's degree. Solutions of these problems should be submitted on separate, signed sheets within five months after publication. Address all communications concerning problems to Leo **Moser**, Mathematics Department, University of Alberta, Edmonton, Alberta, Canada.

PROBLEMS FOR SOLUTION

**45. Proposed by Mel Stover, Winnipeg, Manitoba**

At a faculty meeting attended by six professors, each one left with someone else's hat. The hat taken by **Aitkins** belonged to the man who took **Baily's** hat. The man whose hat was taken by Caldwell, took the hat of the man who took **Dunlop's** hat. Finally, the man who took **Easton's** hat was not the one whose hat was taken by Fort. Who took **Aitkin's** hat?

**46. Proposed by J. Lambek, McGill University**

A partial amnesty having been declared, the jailor unlocked every cell in the prison row. Next he locked every second cell. Then he turned the key in every third cell, locking those cells which were open and opening those which were locked. He continued in this way, on the nth

trip turning the key of every  $n$ th cell. Those prisoners whose cells eventually remained open were allowed to go free. Who were the lucky ones?

**47. Proposed by the problem editor**

Given a finite number of points in a plane such that any three of them may be simultaneously covered by a circle of unit radius. Show that they all may be simultaneously covered by a circle of unit radius.

**48. Proposed by Victor Thébault, Tennie, Sarthe, France**

Find bases  $B$  and  $B'$  such that the number 11, 111, 111, **111** consisting of eleven digits in base  $B$  is equal to the number 111 consisting of three digits in base  $B'$ .

**49. Proposed by C. S. Venkataraman, Trichur, India**

If  $s = (a+b+c+d)/2$  and  $S = a-b-c-d$ , prove that

$$s^4 + (s-b-c)^4 + (s-c-d)^4 - (s-a)^4 - (s-b)^4 - (s-c)^4 - (s-d)^4 = 12S.$$

**50. Proposed by Pedro Piza, San Juan, Puerto Rico**

Prove that the integer  $2n+1$  is a prime if, and only if, for every value of  $r = 1, 2, 3, \dots, [\sqrt{n/2}]$  the binomial coefficient  $\binom{n+r}{n-r}$  is divisible by  $2r+1$ .

**51. Proposed by C. W. Trigg, Los Angeles City College**

Suppose D is the foot of the altitude from C, the vertex of the right angle in the triangle ABC. Show that the area of the triangle determined by the incenters of triangles ABC, ADC, BDC is  $(a+b-c)^3/8c$ .

SOLUTIONS

**6. Proposed by C. W. Trigg, Los Angeles City College**

Starting with a straight edge, closed compasses, and two straight line segments, a and b, construct the harmonic

mean of  $a$  and  $b$  in the least number of operations. Changing the opening of the compasses, drawing a circle or the arc of a circle, and drawing a straight line are each considered an operation.

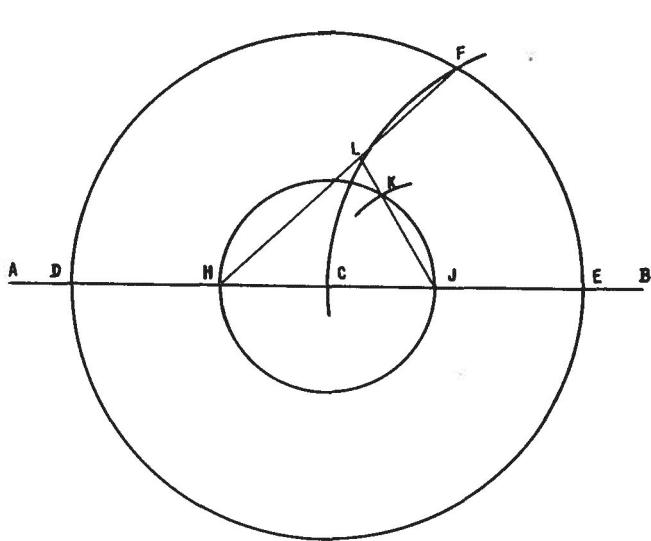


Figure for No. 6, by Bankoff

Solution by Leon Bankoff, Los Angeles, California

The construction described below involves only nine operations.

1. Draw a straight line  $AB$ , conveniently extended.
2. Open compasses to a radius  $a$ .
3. On  $AB$  choose an arbitrary point  $C$  as center and describe a circle of radius  $a$ , cutting  $AB$  in  $D$  and  $E$ .
4. With  $E$  as center and radius  $a$ , describe an arc cutting  $AB$  and the circumference of a circle in  $F$ .
5. Change compass opening to radius  $b$ .
6. With  $C$  as center describe circle of radius  $b$ , cutting  $AB$  in  $H$  and  $J$ .

7. With  $J$  as center and radius  $b$ , describe an arc cutting circle  $C(b)$  in  $K$ .

8. Draw  $HF$ .

9. Draw  $JK$  extended, cutting  $HF$  in  $L$ .  $LJ$  is the harmonic mean of  $a$  and  $b$ .

Proof: Draw  $FE$ , then  $\angle FEA = 60^\circ = \angle LJA$ . In similar triangles  $HLJ$  and  $HFE$ ,  $LJ/FE = HJ/HE$ , or  $LJ/a = 2b/(a+b)$ . So  $LJ = 2ab/(a+b)$ .

No claim is made that this construction involves the least number of operations possible.

28. (Corrected) Proposed by N. S. Mendelsohn, University of Manitoba

The isle of Pythagora, while very sparsely populated, is capable of supporting a population of thirty million. On the sixth day of the twenty-eighth anniversary of his accession to the throne, the king of the island called a meeting of his 496 advisers to divide the real jewels among the people of the land. All the people, including the king and the advisers, were lined up in a single file, and the jewels were distributed as follows.

Starting with the second in line, each person was given one jewel. Starting with the fourth in line, each second person was given two jewels. Starting with the sixth in line, each third person was given three jewels. Starting with the eighth in line, each fourth person was given four jewels, and so on.

The man at the extreme end of the line noticed that the number of jewels he received corresponded to his position in the line.

How many people were there in Pythagora?

Where was the person who got the most jewels standing?

Solution by Francis L. Miksa, Aurora, Illinois

An examination of the conditions reveals that the number of jewels received by each person is the sum of the divisors of his position number  $n$ , with  $n$  itself excluded, or in standard notation  $\sigma(n)-n$ . Hence for a man to receive a number of jewels equal to his position number, his position number must be a "perfect" number, i.e. one of the series

6, 28, 496, 8128, 33550336. Since there are more than 496 and fewer than 30,000,000 people in Pythagora, the only solution is that there are 8128 people there.

To find what number receives the most jewels we must find what number 8129 maximizes  $\sigma(n)-n$ . Using Glaisher's table of number divisors, we find the maximum is attained at  $n = 7560$  and the number of jewels received by the lucky person is  $\sigma(7560) - 7560 = 21240$ .

**35. Proposed by N. S. Mendelsohn, University of Manitoba**

A point moves in a straight line starting from rest and finishing at rest, and covers unit distance in unit time. Prove that at some point its acceleration has a magnitude of at least 4 units.

**Solution by C. W. Trigg, Los Angeles City College**

It is assumed that  $v$  and  $a$  are continuous functions of  $t$ . If we plot  $v$  against  $t$ , the area under the curve must be the same (1 square unit) as that of an isosceles triangle having the same base and an altitude of 2. The slopes of the sides are  $\pm 4$ . Part of the  $v, t$  curve must fall outside the triangle or coincide with its sides. Thus, at some point the slope  $a$  of the curve is numerically  $\geq 4$ .

**Solution by W. Moser, University of Toronto**

By the symmetry of the conditions with respect to initial and final point, we may assume without loss of generality that if  $S = S(t)$  then  $S(\frac{1}{2}) \geq \frac{1}{2}$ . If we further assume  $a(t) < 4$ , then by integration  $v(t) < 4t$  and  $S(t) < 2t^2$ . Hence  $S(\frac{1}{2}) < \frac{1}{3}$ , a contradiction which proves the required result.

Also solved by the proposer.

**38. Proposed by C. W. Trigg, Los Angeles City College**

In the triangle ABC, AA' is a median. Prove that if

$$\frac{AM}{MA'} = \frac{p}{q}$$

then CM extended divides AB in the ratio  $\frac{p}{2q}$ .

**Solution by R. W. Hippe, Saint Louis University**

Let CM extended meet AB in N. Construct from A' a line parallel to NC intersecting AB in D. Now  $BA' = A'C$  implies  $BD = DN$ . Further, the line MN, being parallel to the base of the triangle AA'D, cuts the sides AA' and AD proportionally, hence

$$\frac{p}{q} = \frac{AM}{MA'} = \frac{AN}{ND} = \frac{2AN}{NB}$$

which completes the proof.

Also solved by Leon Bankoff, D. W. Barnum, R. Chaffee, J. E. Faulkner, and the proposer.

**39. Proposed by Pedro Piza, San Juan, Puerto Rico**

Find digits m, a, b, c, d, e, f such that

$$\frac{9m+1}{9m} \cdot a b c d e f = f e d c b a$$

**Solution by F. L. Miksa, Aurora, Illinois**

There are nine solutions:

$$\begin{aligned} 9 \times 109890 &= 10 \times 098901 \\ 18 \times 208791 &= 19 \times 197802 \\ 27 \times 307692 &= 28 \times 296703 \\ 36 \times 406593 &= 37 \times 395604 \\ 45 \times 505494 &= 46 \times 494505 \\ 54 \times 604395 &= 55 \times 593406 \\ 63 \times 703296 &= 64 \times 692307 \\ 72 \times 802197 &= 73 \times 791208 \\ 81 \times 901098 &= 82 \times 890109 \end{aligned}$$

Also solved by the proposer.

**42. Proposed by Mel Stover, Winnipeg, Manitoba**

Prove that the volume of a tetrahedron determined by two line segments lying on two skew lines is unaltered by sliding the segments along their lines (but leaving their lengths unaltered).

**Solution by Leon Bankoff, Los Angeles, California**

Let one segment remain stationary while the other is

permitted to vary its position. The area of the triangle formed by the sliding segment as base and an extremity of the stationary segment as vertex is constant in area. Moreover, the distance of the other extremity of the fixed segment to the plane of the variable triangles is also constant. Since the determining factors (base and altitude) remain constant, the volume of the tetrahedron is unaltered.

Also solved by C. W. Trigg and the proposer.

**43. Proposed by Paul W. Gilbert, Syracuse University**

Four solid spheres lie on top of a table. Each sphere is tangent to the other three. If three of the spheres have the same radius  $R$ , what is the radius of the fourth sphere?

Solution by Leon **Bankoff**, Los Angeles, California

The small sphere, radius  $r$ , touches the table at a point equidistant from the contacts of each of the large spheres with the table. Hence it lies on the circumcenter of an equilateral triangle the side of which is  $2R$ . Then  $(R+r)$  is the hypotenuse of a right triangle the altitude of which is  $(R-r)$  and the base of which is  $2R\sqrt{3}/3$ . So  $(R+r)^2 = (R-r)^2 + 4R^2/3$ , and  $r = R/3$ .

Also solved by E. Faulkner and C. W. Trigg.

**44. Proposed by Paul W. Gilbert, Syracuse University**

Assuming that  $c$  is a positive constant, solve the following equation for  $x$ :

$$2 \log_c C - \log_{cx} C - 3 \log_{c^2x} C = 0.$$

Solution by Leon **Bankoff**, Los Angeles, California

We use the relation  $(\log_a b)(\log_b a) = 1$ , and let  $\log_c x = y$ . Then we have:

$$\begin{aligned} 2/\log_c x - 1/\log_c cx - 3/\log_c c^2x &= 0, \\ 2/y - 1/(1+y) - 3/(2+y) &= 0, \\ 2y^2 - y - 4 &= 0, \\ \log_c x = y &= (1 \pm \sqrt{33})/4, \\ x = C^y &= C^{(1 \pm \sqrt{33})/4}. \end{aligned}$$

Also solved by C. W. Trigg and Earl Faulkner.

## NOTES

Of the two hundred and seventeen doctorates,\* with mathematics, mathematical physics, or statistics as a major subject, conferred during the year 1951 by the universities in the United States and Canada, sixty-nine of these are known to have gone to persons who had been previously initiated into Pi Mu Epsilon at universities within the United States. The list given below was checked against chapter records and cannot be complete because many of our members, after being initiated into the Fraternity, transferred to other universities to work on their doctorates, in some cases to a university where there was no chapter of Pi Mu Epsilon, and in such cases there was no way for the editor to check membership in the Fraternity. When the list was being prepared, the Secretary-General kindly made available his lists (by chapters) of initiates who had received certificates of membership. Had time permitted no doubt the names of many others, whose names properly belong in the list we are publishing, might have been found. It is our intention to publish annually the list of names of our members who take their doctorates, in that year, whenever such information is made available (The corresponding secretaries of the chapters can help us with this.); also, we should like to be able to inform our readers where these new doctors of philosophy are presently employed.

University of California, Los Angeles:

W. G. BADE (1947), June, "An operational calculus for operators with spectrum confined to a strip."

MILTON DRANDELL (1947), June, "Generalized convex sets in the plane."

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\*Bull. Am. Math. Soc., vol. 58, May 1952, pp. 424-435.

I. L. GLICKSBERG (1945), June, "Cesaro summation in harmonic analysis in groups."

E. R. IMMEL (1949), June, "Problems of estimation and of hypothesis testing connected with birth-and-death Markov processes."

M. L. STEIN (1947), January, "On methods for obtaining solutions of fixed end point problems in the calculus of variations."

#### University of California, Berkeley:

O. R. AINSWORTH (1946), September, "Theory of waves from a point source in one of two semi-infinite contiguous elastic media."

E. A. DAVIS (1939), June, "A dynamic economic theory."

J. M. G. FELL (1947), January, "On L-spaces."

A. R. LOVAGLIA (1948), September, "Locally uniformly convex Banach spaces."

W. K. SAUNDERS (1948), July, "Existence of the solution of the exterior problem of the electromagnetic field."

MAURICE SION (1947), June, "On the existence of functions having given partial derivatives on Whitney's curve."

W. F. TAYLOR (1942), January, "On tests of hypotheses and best asymptotically normal estimates related to certain biological tests."

#### University of Georgia:

W. D. PEEPLES, Jr. (1948), June, "Elliptic curves and rational distance sets."

G. O. PETERS (1948), August, "Bernoulli polynomials of the second kind of higher order. Euler polynomials of the second kind of first and higher orders. Boole polynomials of the first and second kinds of higher order. Bernoulli, Euler, and Boole series and functions of negative degree."

#### University of Illinois:

P. F. CONRAD (1948), June, minor in philosophy, "Embedding theorems for Abelian groups with valuations."

B. E. HOWARD (1946), June, minor in electrical engineering, "Hydrodynamic properties of an electron gas."

W. R. ORTON, Jr., June, "Representation of functions of a complex variable and related integral equations."

L. L. SCOTT (1947), October, "Finite metabelian groups and planes of  $\Sigma_{14}$ ."

L. J. SNELL (1944), October, minor in physics, "Applications of martingale system theorems."

#### Northwestern University:

G. M. BLOOM (1949), June, "On the total variation of solutions of the bounded variation moment problem."

#### Iowa State College:

R. J. LAMBERT (1948), July, minor in physics, "Extension of normal theory to general matrices."

R. F. REEVES (1949), June, minor in physics, "Force fields in which centers of gravity can be defined."

A. M. WEDEL (1948), July, minor in physics, "Volterra transforms of some hypergeometric series."

#### University of Kansas:

W. K. MOORE (1948), June, minor in physics, "The characterizations of a class of transformations and of differentiable functions."

#### University of Kentucky:

ELSIE T. CHURCH (1943), June, Inversion with respect to a cubic of the syzygetic pencil."

A. E. FOSTER (1947), August, "A generalized harmonic conjugate for commutative algebras."

#### Louisiana State University:

R. L. BROUSSARD (1947), August, "A necessary and sufficient condition that a set be homeomorphic to a plane

region bounded by a finite number of nonintersecting circles."

University of Missouri:

J. W. GADDUM (1948), August, "Metric methods in integral and differential geometry."

J. W. SAWYER (1948), August, "A study of metric torsion."

Washington University:

RUTH L. POTTER, May, "Oscillation and boundedness of solutions of a second-order linear differential equation."

Syracuse University:

H. H. CHANG (1948), January, "Approximately analytic functions of bounded type and boundary behavior of solutions of elliptic partial differential equations."

ROBERT FINN (1947), June, "On some properties of the solutions of a class of non-linear partial differential equations."

F. P. PU (1948), January, "Some inequalities in certain non-orientable Riemannian manifolds."

DANIEL RESCH (1947), January, "Some Baecklund transformations of partial differential equations of second order."

JAMES SANDERS (1949), June, "Some classes of partial differential equations of the fourth order."

New York University:

J. R. KNUDSON, May, "A study of effects of viscosity and heat conductivity on the transmission of sound waves in a compressible fluid."

J. R. LURYE, May, "Electromagnetic reflection and transmission matrices of a continuously stratified anisotropic medium by variational technique."

F. V. POHLE, January, "The Lagrangian equations of

hydrodynamics: Solutions which are analytic functions of the time."

Duke University:

R. T. HERBST (1949), June, minor in physics, "Reduction of passive orthonomic differential systems to passive systems of the first order."

S. M. SPENCER, Jr. (1949), June, minor in philosophy, "Transcendental numbers over certain function fields."

University of North Carolina:

L. P. BURTON, June, "Minimax solutions of ordinary differential systems."

W. S. CONNOR (1949), August, "The structure of balanced incomplete block designs and the impossibility of certain unsymmetrical cases."

T. L. REYNOLDS (1947), June, "On the impossibility of an odd perfect number not divisible by five with six different prime divisors."

J. H. WAHAB (1949), June, "Some new cases of irreducibility for Legendre polynomials."

Ohio State University:

NORMAN LEVINE (1948), August, "Absolutely continuous product transformations in the plane."

University of Oklahoma:

E. V. GREER (1950), June, minor in physics, "A theorem on planar transformations."

E. J. PIPES (1950), August, minor in physics, "Properties of sets and functions relative to exceptional sets."

University of Oregon:

L. P. H. CHEO (1950), June, "The density of the sum of sets of Gaussian integers."

J. E. MAXFIELD (1948), June, "Normal numbers in  $k$  dimensions."

MARGARET W. MAXFIELD, June, "Format's theorem for matrices over a modular ring."

F. H. YOUNG (1938), June, "A matrix transformation of Fourier coefficients."

#### University of Pennsylvania:

G. H. BUTCHER (1943), February, "An extension of the sum theorem of dimension theory."

LELIA A. DRAGONETTE (1948), June, "Asymptotic formulae for the mock theta series of Ramanujan."

PHILIP RABINOWITZ (1945), June, "Normal coverings and uniform spaces."

ALBERT SCHILD (1948), February, "On a problem in conformal mapping of schlicht functions."

#### Lehigh University:

J. O. CHELLEVOLD (1949), June, "Singular quadratic functions for  $n$  dependent variables."

#### Carnegie Institute of Technology:

R. L. ELY (1948), June, "Forced vibrations of continuous beams under pulsating, moving loads."

T. R. GREENE (1950), June, "Water waves in channels of infinite depth."

E. P. KING (1947), June, "The operating characteristic of the control chart for sample means when process standards are unspecified."

K. H. KRAMER (1948), June, "The distribution of range in compositions of normal universes."

RAYMOND SEDNEY (1948), June, "On the hydrodynamical theory of lubrication. I. The Reynolds lubrication equation with smooth outflow. II. The finite length journal bearing with high eccentricity."

H. C. VOLKIN (1947), June, "Rotating and accelerated reference systems."

H. J. WEISS (1947), June, "Structural stability of thin-walled open sections."

#### University of Wisconsin:

W. F. DONOGHUE, Jr. (1949), August, minor in physics, "The bounded closure of locally convex spaces."

W. H. FLEMING (1950), August, "Boundary and related notions for generalized parametric surfaces."

D. R. FULKERSON (1948), January, "Quasi-Hermit forms of row-finite matrices."

MELVIN HENRIKSEN (1950), August, "On the ideal structure of the ring of entire functions and other function rings."

K. T. SMITH (1949), August, "The L-B topology in locally convex spaces."

Many will recall the article entitled "A certain property of continuous functions" written by Melvin Hausner of Brooklyn College, which appeared in Volume 1, Number 1, this Journal. The article was written while Melvin was an undergraduate. In June, 1951, he was awarded the Doctor of Philosophy Degree by Princeton University, the title of his doctoral thesis being "Dirichlet's principle and generalized boundary values." We understand he is presently a member of the mathematics staff at Brooklyn College. Congratulations, Melvin! You have brought honor and distinction to both your Alma Mater and Pi Mu Epsilon.

\* \* \*

Professor Albert Einstein once gave what he considered the best formula for success in life. He said, "If  $a$  is success in life, I should say the formula is  $a = x + y + z$ ,  $x$  being WORK and  $y$  being play."

"And what is  $z$ ?", inquired the interviewer.

"That," he answered, "is keeping your mouth shut."

#### DEFINITION

Desk — A wastebasket with drawers.

## REPORTS OF THE CHAPTERS

(Send reports to Ruth W. Stokes, 15 Smith College, Syracuse University, Syracuse 10, New York.)

**EDITOR'S NOTE.** According to Article VI, Section 3 of the Constitution: "The Secretary shall keep account of all meetings and transactions of the chapter and, before the close of the academic year, shall send to the **Secretary-General** and to the **Director-General**, an annual report of the chapter activities including programs of meetings, results of elections, etc." The **Secretary-General** now suggests that an additional copy of the annual report of each chapter be sent to the editor of the Pi Mu Epsilon Journal. Besides the information listed above we are especially interested in learning what the chapters are doing by way of competitive examinations, medals, prizes and scholarships. These annual reports will be published in the chronological order in which they are received.

### Beta of North Carolina, University of North Carolina

The following papers were presented at meetings of the North Carolina Beta chapter during the academic year 1951-1952:

"The Educational System of England as related to the development of prospective mathematics students" by Dr. Doris Lee, University of London, London, England

"Characteristic roots of matrices" by Gene Medlin

"Relation of the **Euler-Fermat** Theorem to matrices" by Alex Davis

"Time series" by Sudhish Ghurye (Dept. of Math. Statistics)

"Flat Lands" by Bill Chapman, Duke University

"Theory of some simple games" by Dr. A. Brauer.

The first and last meetings of this academic year were business meetings.

A picnic in honor of Dr. Thomas Felix Hickerson was sponsored by the chapter on May 17, 1952.

The chapter established a Pi Mu Epsilon library consisting of undergraduate texts and periodicals.

During the present academic year there **has** been an increase of about 285% in membership.

Officers for 1951-1952 **were: Director**, Tullio J. Pignani; **Vice-Director**, Mrs. Mary Nunn Morrow; **Secretary**, John Jones, Jr.; **Treasurer**, Mrs. Margaret Butler Seelbinder.

Officers elected for 1952-1953: Director, Edward E. Grace; Vice-Director, Paul S. Herwitz; **Secretary**, C. V. Williams Jr.; **Treasurer**, Richard J. Painter; **Chairman at Awards** and Scholarship Committee, Hasell T. La Borde.

### Alpha of Michigan, Michigan State College

The Michigan Alpha Chapter held twelve meetings during the year 1951-1952, including business **meetings**, program meetings, initiations, the annual winter banquet and the **spring** picnic. Topics at program meetings were as follows:

"The theory of measurement" by Dr. H. S. Leonard

"The rate of interest in installment **buying**" by Dr. H. E. Stelson

"Mathematics in its application to the movement of underground waters" by Mr. John G. Ferris

"Four biographical sketches of mathematicians (Cauchy, Galois, Leibnitz and Gauss) by student speakers (John Long, Henry Leonard, Hugo Myers and W. G. Franzen)

"Summing series by means of indeterminate coefficients" by James Monsma

"Fake coin problem" by Charles Parker

A talk on visual aids by Russell Schneider

"Pascal's Triangle" by Dale Mesmer

"Rotation of spheres" by Mrs. Mary H. Payne

"Some uses of mathematics in genetics" by Dr. H. R. Hunt.

Officers for the year 1952-1953 are: President, George Hazelworth; Vice-president, Walter Reid; **Secretary**, Mary Hutchinson; Treasurer, George Hess; Permanent **Secretary**, James Powell; Faculty Advisors, Dr. L. M. Kelly and Dr. J. E. Powell.

### Alpha of the District of Columbia, Howard University

The District of Columbia Alpha chapter held eight meetings during the academic year 1951-1952. The following talks were presented at program meetings:

"Some visits to physics and mathematics departments of

several European Universities<sup>n</sup> (illustrated with Kodachrome slides) by Dr. Herman Branson

"Construction of normal orthogonal systems and applications" by Dr. George Butcher

"A property of sequences<sup>n</sup> by Dr. David Blackwell

"Toeplitz matrices<sup>n</sup> by Dr. George Butcher

"Keplar's laws of planetary motion as derived from Newton's laws of motion and law of universal gravitation" by Dr. Allen Maxwell

"The principle of fair division" by Dr. David Blackwell.

The initiation meeting was held in May. Three new members joined the chapter.

In the Spring Quarter David Franks was elected to the presidency left vacant by the resignation of Lt. Robert N. Smith, USAF.

Officers for 1951-1952 were: Director, Dr. George Butcher; President, Lt. Robert N. Smith (Sept. - March) and David A. Franks (March - June); Secretary, Mrs. Andretta Yeldell; Treasurer, Young Lee.

#### Alpha of Louisiana, Louisiana State University

The first meeting of the Louisiana Alpha chapter for the 1951-1952 session was held October 11, and the following officers were elected for the year: Director, Ezra J. Westbrook; Vice-Director, Gleb Mamantov; Secretary, Lynden Howell; Treasurer, Carlton Strickland; Corresponding Secretary, Professor Houston T. Karnes.

The following papers were presented before the chapter during the academic year:

"Monte Carlo methods in probability" by Dr. Ernest S. Elyash  
'Another way of doing it<sup>n</sup> by Dr. Paul K. Rees

"Giant brains<sup>n</sup> by Dr. Fred H. Fenn.

The annual Pi Mu Epsilon lectures this year were given by Dr. W. M. Whyburn, Vice-Director General of Pi Mu Epsilon and head of the department of mathematics at the University of North Carolina. For the afternoon lecture, his topic was "Linear differential equations<sup>n</sup>, and his evening lecture was on "Mathematics for the muddled".

The annual initiation and banquet were held on May 1, 1952. Twenty-five new members were initiated.

#### Gamma of Kansas, University of Wichita

The Kansas Gamma chapter held five meetings during the academic year 1951-1952. These included three business meetings and two for initiation, one of which was the annual dinner meeting.

At the December meeting two new members were initiated, and a paper, "Fitting of polynomial equations to empirical data", was presented by William Parks.

More new members were elected at the March and April meetings, bringing the total for the year to ten new members. Included in the business transacted by the chapter at the March meeting was the decision to provide sufficient funds to take care of the expenses of any undergraduate or graduate student who wished to attend the meeting of the Kansas Section of the Mathematical Association of America.

Besides the initiation ceremony at the annual dinner meeting, there was a talk by Professor Arnold Wedel, member of Pi Mu Epsilon and head of the department at Bethel College. His topic was "Volterra's theory of composition."

#### Gamma of Missouri, St. Louis University

The first 1951-1952 meeting of Pi Mu Epsilon, Missouri Gamma chapter, was held November 3, 1951, at Fontbonne College. Forty-nine members and guests were present. William Golomski was elected Vice-Director to succeed Richard Kern, and Bernard Jansen was elected Secretary-Treasurer to succeed Virginia Herre. Rev. Lester Heider, S. J., spoke on "Boolean Algebra." Refreshments were served after the meeting.

The second meeting was held December 12, 1951, at St. Louis University. Thirty members and guests were present. Dr. John J. Andrews of the St. Louis University Staff, lectured on "Probability."

The third meeting was held March 15, 1952 at Maryville College. Forty members and guests were present. Mother Marie Kernaghan, R.S.C.J., Associate Professor of Physics, Maryville College, spoke on "The Life and Works of George David Birkhoff." The meeting was followed by a social hour in the Student Lounge.

The fourth and final meeting of the academic year was held May 1, 1952, at St. Louis University, Commerce and Finance School. One hundred and thirty-five members and guests were present. Eighty-two new members were inducted into the chapter,

bringing the total membership since the chapter was granted to six hundred and thirty-five and total active membership to two hundred and ninety. William Golomski was elected Director for the academic year 1952-53 to succeed Eugene Bold. (Election of Vice-Director and Secretary-Treasurer will be held at the first meeting in the fall of 1952.) After the business meeting Professor W. L. Ayres, Dean of the Science School, **Purdue** University, gave a lecture on "A one-dimensional world". Following the lecture a reception was held to honor Professor Ayres and the new initiates. Then followed the fifteenth annual banquet held in Des Peres Hall, at which Director Bold was toastmaster. One hundred and twenty members and guests were present. Among the honored guests were Rev. Robert J. Henle, S. J., Dean of the Graduate School, St. Louis University, and Professor Ayres.

Dr. Francis **Regan** has again accepted the post of Faculty Adviser and Permanent Secretary-Treasurer of the chapter.

#### Gamma of New York, Brooklyn College

The New York Gamma chapter elects officers twice a year. During the academic year 1951-1952 the chapter elected the following officers:

	Fall, 1951	Spring, 1952
Director	Professor M. Richardson	Professor M. Richardson
President	Joseph Sucher	Alan J. <b>Goldman</b>
Vice-Pres.	Alan <b>Goldman</b>	Joel Lebowitz, <b>Irving</b> Katz
Secretary	Martin <b>Milgram</b>	Laura <b>Chiarulli</b>
Treasurer	Ruth Beller	Audrey Riemer

The chapter initiated into membership thirty students and two faculty members. The latter, called "**honorary** inductees", were Professor Martin E. Lean (of the philosophy department) and Professor **Melba** Phillips (of the physics department).

The chapter does not use students as speakers. However, at the meetings of the Brooklyn College Mathematics Society, both students and faculty lecture and present papers. Lectures given before the chapter last year were:

"Mathematical curves on the oscilloscope" by Professor Green of the Physics Department of Brooklyn College

"Topology and the foundations of geometry\*" by Professor **Zippin** of the Mathematics Department of Queens College

"Relativity without mathematics" by Professor **Banesh** Hoffmann of the Mathematics Department of **Queens** College

"Geometry of crystals" by Professor **Brody** of the Physics Department of Brooklyn College.

Papers given before the Mathematics **Society** by student members of Pi Mu Epsilon were:

"Metric spaces\*" and "The bilinear transform" by Alan J. **Goldman**\*

"**Stirling's** formula and probability<sup>8</sup> and "Fourier series" by Paul Cohen

"Lattice theory" by Joseph Sucher.

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\*Alan J. **Goldman** gave one of the student papers at the East Lansing, Michigan, meeting. See "Program" printed elsewhere in this journal.

## MEDALS, PRIZES AND SCHOLARSHIPS

EDITOR'S NOTE. Each chapter undoubtedly will be interested in learning what other chapters are doing along the line of prize competitions. So the editor makes the request that chapters offering prizes, scholarships, or other awards, write up their plans for such contests and submit them for publication in this journal.

In the 1951-1952 academic year, the North Carolina Beta chapter established an award to be made annually to each of the two persons achieving the highest scores in a statewide high school mathematics contest.

The Missouri Alpha's report on prize winners in the annual calculus competition May 13, 1952, is as follows: First prize of \$15.00, to James **Fithian**; second prize, \$10.00, Delmar Van Meter; third prize, \$5.00, Donald Meyer.

The Michigan Alpha chapter annually makes the L. C. Plant awards. These are given to the students who have in the past year contributed the most to mathematics through scholarship, interest in mathematics and help to the mathematics department. At the winter banquet for the year 1951-1952, the awards were presented to Mary Hutchinson, Henry Leonard and Harry **Achziger** by Dr. J. S. Frame, head of the mathematics department.

The Louisiana Alpha chapter made the following awards at their annual banquet, May 1, 1952: Senior award to Jasper A. Welch, Jr., of Baton Rouge, Louisiana; freshman award to Robert E. Cavanaugh, of Leesville, Louisiana.

Three prizes were awarded by the Missouri Gamma chapter during the year 1951-1952. The sixth annual Prize Essay Contest was conducted by Professor Alois **Lorenz**. The prize for the senior undergraduate division was won by Ying-nien Yu, a student at Park College. The title of his paper was "Daniel Bernoulli's hydrodynamical equation." His prize was D. E. Smith's "Source Book of Mathematics." Roland Nokes, also of Park College, won the junior prize for his essay, "Daniel Bernoulli." He received a copy of E. T. Bell's "**Men** of Mathematics." Dr. Francis **Regan**, director of the department of mathematics, awarded The Garneau Mathematics Award of twenty-five dollars to Louise **Renard** for being the highest ranking senior majoring in mathematics.

At the October 17, 1951, meeting of the **Kansas Gamma** chapter there **was** made the annual award of the Pi Mu Epsilon Mathematical Scholarship, the recipient being Ann Klein.

## DIRECTORY

of

### PI MU EPSILON FRATERNITY, INC.

\*

#### General Officers (1951-1954)

Director General: Professor C. C. **MacDuffee**, 202 North Hall, University of Wisconsin, Madison 6, **Wisconsin**

Vice-Director General: Professor W. M. **Whyburn**, Department of Mathematics, University of North **Carolina**, Chapel Hill, North Carolina

Secretary-Treasurer General: Professor J. S. **Frame**, 207 Physics-Mathematics Bldg., Michigan **State** College, East Lansing, Michigan

Councilors General:  
Professor S. S. Cairns, Department of Mathematics, University of Illinois, **Urbana**, Illinois

Professor **Tomlinson** Fort, Department of Mathematics, University of Georgia, Athens, Georgia

Professor Sophia McDonald, Department of Mathematics, University of California, Berkeley, **California**

Professor Ruth W. Stokes, Department of Mathematics, **Syracuse** University, Syracuse 10, **New York**

Mr. Howard C. Bennett (ex **officio**), Department of Mathematics, Syracuse University, Syracuse 10, **New York**

FALL 1952 ROSTER OF THE FIFTY-ONE  
ACTIVE CHAPTERS WITH CHARTER DATE

Corresponding Secretaries<sup>1</sup>  
1952 - 1953<sup>2</sup>

- ( 5) Alabama Alpha, 1922, University of Alabama, University, Ala.; Dr. H. S. Thurston, Department of Mathematics
- (40) Arizona Alpha, 1941, University of Arizona, Tucson, Arizona; Dr. R. F. Graesser, Department of Mathematics
- (22) Arkansas Alpha, 1931, University of Arkansas, **Fayetteville**, Arkansas; Mary John Skillern, 208 N Church Street
- (12) California Alpha, 1925, University of California, Los Angeles 24, California; Faculty Adviser: Prof. W. T. **Puckett**, Department of Mathematics
- (19) California Beta, 1930, University of California, Berkeley 4, California; Mrs. Sophia L. **MacDonald**, Dept. of Mathematics
- (33) Colorado Alpha, 1936, University of Colorado, Boulder, Colo.; Mr. **Edmund H.** Brown, 2500 **Goss** B.
- (50) Colorado Beta, 1950, University of Denver, Denver, Colorado; Miss Katherine C. Garland, Department of Mathematics
- (41) Delaware Alpha, **1941**, University of Delaware, Newark, Del.; Professor Russell Remage, **Jr.**, Dept. of Mathematics
- (52) District of Columbia Alpha, 1951, Howard University, Washington 1, D. C.; Mrs. **Andretta A.** Yeldell, 3778 Hayes St. N. E., Apt. 1

<sup>1</sup>The name and address of the Permanent Secretary, or Corresponding Secretary, is given for each chapter which replied to the May 1952 questionnaire sent out by the Secretary general; otherwise, that of the Faculty Adviser or Department Chairman.

<sup>2</sup>Number appearing before chapter designation indicates chronological order in which charter was granted.

- (51) Florida Alpha, 1951, University of **Miami**, Coral Gables 46, Florida; Mr. Robert Fitzgerald, 10907 **N. E.** 8 Ave., Miami, Florida
- (29) Georgia Alpha, 1934, University of **Georgia**, Athens, Georgia; Professor W. S. Beckwith, 731 **Cobb Street**
- ( 7) Illinois Alpha, 1924, University of **Illinois, Urbana**, Illinois; Mr. **J. H. Abbott**, Box 64, University **Station**
- (42) Illinois Beta, 1944, Northwestern University, **Evanston**, Ill.; Mr. Daniel Wilson, 6134 N. Francisco, Chicago, Illinois
- ( 6) Iowa Alpha, 1923, Iowa State College, **Ames, Iowa**; Professor Ralph **M. Robinson**, 1222 **Northwestern**
- (16) Kansas Alpha, 1928, University of **Kansas, Lawrence**, Kansas; Prof. Wealthy **Babcock**, 209 **Strong Hall**, Department of Mathematics
- (31) **Kansas** Beta, 1935, Kansas State College, **Manhattan**, Kansas; Prof. W. T. Stratton, Department of **Mathematics**
- (49) Kansas Gamma, 1950, University of **Wichita, Wichita** 14, Kan.; Professor C. B. Read, Department of **Mathematics**
- (13) Kentucky Alpha, 1927, University of **Kentucky**, Lexington, Ky.; Dr. H. H. Downing, Department of **Mathematics**
- (38) Louisiana Alpha, 1939, Louisiana **State** University, Baton Rouge 3, Louisiana; Professor H. T. **Karnes**, **Department** of Mathematics
- (39) Michigan Alpha, 1940, Michigan State College, East Lansing, Michigan; Prof. Fritz Herzog, **Département** of Mathematics
- ( 4) Missouri Alpha, 1922, University of **Missouri**, Columbia, Mo.; Professor Mary **Cummings**, 212 Engineering **Building**
- (11) Missouri Beta, 1925, Washington University, **St. Louis** 5, Mo.; Professor Jessica Young Stephens, **Dept.** of Mathematics
- (43) Missouri **Gamma**, 1945, **St. Louis University**, **St. Louis**, Mo.; Professor Francis **Regan**, **Department** of Mathematics
- ( 9) Montana Alpha, 1925, Montana **State** University, **Missoula**, Montana; Prof. George Marsaglia, **Montana State** University

- (15) Nebraska Alpha, 1928, University of Nebraska, Lincoln, Neb.; Faculty Adviser: Dr. Edwin Halfar, Department of Mathematics, 213 **Burnett** Hall, University of Nebraska
- (45) New Hampshire Alpha, 1948, University of New Hampshire, Durham, N. H.; Mr. Donald Childs, Director IIME, University of **New Hampshire**
- (1) New York Alpha, 1914, Syracuse University, Syracuse 10, New York; Professor Nancy Cole, Department of Mathematics
- (10) New York Beta, 1925, Hunter College, 695 Park Ave., New York 21, N. Y.; Prof. Jewel Bushy and Miss Leila Singh, Department of Mathematics
- (26) New York **Gamma**, 1933, Brooklyn College, **Bedford** Ave. and Ave. H, Brooklyn 10, N. Y.; Prof. J. Singer, Department of Mathematics
- (28) New York Delta, 1933, N. Y. University, 100 Washington Sq. East, New York 3, N. Y.; Mr. William G. Zoellner, 93 **Eaton** Place, E. Orange, New Jersey
- (30) New York Epsilon, 1935, St. Lawrence University, Canton, New York; Mr. John Taylor, 27 State Street
- (53) New York Eta, 1951, University of Buffalo, Buffalo 14, N. Y.; Mr. Howard W. Baeumler, Department of Mathematics
- (24) North Carolina Alpha, 1932, Duke University, Durham, N. C.; Prof. F. G. **Dressel**, 309 Frances Street
- (46) North Carolina Beta, 1948, University of N. C., Chapel Hill, North Carolina; Dr. John W. Lasley, Jr., 523 E. Rosemary St.
- (2) Ohio Alpha, 1919, Ohio State University, Columbus, Ohio; Mr. Pat H. **Sterbenz**, Brand Road, **Worthington**, Ohio
- (13) Ohio Beta, 1927, Ohio Wesleyan University, Delaware, Ohio; Prof. Sidney A. **Rowland**, 45 Oak Hill Ave.

- (32) Ohio Gamma, 1936, University of **Toledo**, Toledo, Ohio; Dr. Wayne Dancer, Department of **Mathematics**
- (48) Ohio Delta, 1949, Miami University, **Oxford**, Ohio; Dr. H. S. **Pollard, Upham** Hall
- (18) Oklahoma Alpha, University of **Oklahoma, Norman**, Oklahoma; Professor Dora **McFarland**, Department of Mathematics
- (35) Oklahoma Beta, Oklahoma A and **M. College, Stillwater, Okla.**; Professor James H. Zant, Department of Mathematics
- (21) Oregon Alpha, 1931, University of **Oregon**, Eugene, Oregon; Dr. K. S. Ghent, Department of **Mathematics**
- (36) Oregon Beta, 1938, Oregon State College, **Corvallis**, Oregon; Professor George A. Williams, **Dept.** of Mathematics
- (3) Pennsylvania Alpha, 1921, **University of Pennsylvania**, Philadelphia 4, Pennsylvania; Dr. R. D. **Shafer**, Department of **Mathematics**
- (8) Pennsylvania Beta, 1925, Bucknell **University, Lewisberg**, Pa.; Mr. D. **Ohl**, Director **TIME, Bucknell** University
- (17) Pennsylvania Gamma, 1929, **Lehigh University, Bethlehem**, Pa.; Professor R. R. **Stoll**, Department of **Mathematics**
- (20) Pennsylvania Delta, 1930, **Pennsylvania State** College, State College, Pennsylvania; Prof. **Orrin Frink**, Department of Mathematics
- (44) Pennsylvania Epsilon, 1947, **Carnegie** Inst. of Tech., Pittsburgh 12, **Pennsylvania**; Mr. Richard C. Di Prima, **Dept.** of Mathematics
- (47) Virginia Alpha, 1948, University of **Richmond**, Richmond, Va.; Professor E. S. Grable, **Box 45, University** of Richmond
- (25) Washington Beta, 1932, University of Washington, Seattle 5, Washington; Prof. Lee H. **MacFarlan**, Department of Mathematics
- (27) Wisconsin Alpha, 1933, **Marquette University**, Milwaukee 3, Wisconsin; Dr. H. P. Pefflt, Department of **Mathematics**
- (37) Wisconsin Beta, 1939, University of **Wisconsin**, Madison 6, Wisconsin; Mr. Marshall F. Ruchte, 803 **State St.**, Madison 5, **Wis.**

## INITIATES, ACADEMIC YEAR 1951-1952

ALABAMA ALPHA, University of Alabama  
(Fall, 1951)Margaret Ann Alison  
Ed. Barker, Jr.  
Arthur C. BentleyRoma J. Cormier  
S. Ashby Foote  
Alfred Goode  
Sarah JensenScott Spaulding  
Roger Wicks  
Alfred W. Yonda

(Spring, 1952)

Gunnar Anderson  
Rex L. Callaway  
Gary W. CrainFrances Gaynor  
John S. Henderson  
B. Pauline LowmanShirley McCallum  
David L. McElroy  
Mary Jo WigginsARIZONA ALPHA, University of Arizona  
(May 8, 1952)Abbas N. Al-Khafaji  
David C. Allais  
Donald A. Anhorn  
Kenneth A. Fowler  
Sue L. Gin  
Max R. GrundvigLeland Harris  
Richard C. Heyser  
Martin Hochdorf  
Gale Holladay  
Raymond J. Jimenez  
Paul E. Koenig  
Gary LottoJohn O. Maloy  
Ernest G. McCray  
Stanley D. Spray  
Harold E. Sweeney  
Charles D. Vail  
Janis J. ZalmansCALIFORNIA ALPHA, University of California, Los Angeles  
(Spring, 1952)Miriam Ann Caldwell  
Jan Drent  
Steve Gaspar  
Richard Carl GilbertTomo-aki Hayata  
Raymond Paul Kachelmeyer  
Luther Clark LayStanley Robert Lenihan  
Edgar Reich  
Marjory Irene Thorn  
Edward Oakley ThorpCALIFORNIA BETA, University of California, Berkeley  
(May 17, 1952)Fariborz Amini  
Alexander B. Cecil  
Walter L. Dieckmann  
Robert DonatiRandolph Eidemiller  
Lee O. Heflinger  
Robert Holten  
William Keating  
Milton LeesJoseph Rosenbaum  
Rex Shudde  
Margaret Swanson  
Paul B. YaleRobert Alfred Baird  
Edmund H. BrownMorton David Davis  
Leburne Walter Farr  
David Page LarsenBernard Mozer  
Betty May SherbaCOLORADO BETA, University of ~~Denver~~  
(March 12, 1952)Donald L. Beaumont  
Forrest W. Brinkley  
Frank Cenkovich  
James F. DeSanto  
Arthur J. DoneganRobert W. Harris  
Alan Henrikson  
Irwin J. Hoffman  
George KinoshitaJim Lindsay  
Amelia Miller  
Thomas E. Mullins  
Leo M. Piecha  
Stuart L. RiebenFLORIDA ALPHA, University of ~~Miami~~  
(Date of initiation not given)Edward Burger  
Robert FitzgeraldSeymour Ginsburg  
Walter Roop  
Francis S. ShayFrank J. Shea XI  
Helene D. SmithGEORGIA ALPHA, University of ~~Georgia~~  
(January 23, 1952)Rubin Gotesky  
Charles W. HuffVivian Karanangeli  
Garnett R. McMillanJeannette Newton  
Lawrence A. Nix, Jr.

(May 21, 1952)

Eloise Eavenson  
Lois Sue HaleBenjamin B. McLeroy  
Roy B. TuckerCharles Emory Willett  
James BercosILLINOIS BETA, Northwestern University  
(May 29, 1952)Barry Alper  
Norman Bartelt  
David Beckman  
Mathew Betz  
George Blomgren  
Robert Brand  
Bruce Broker  
Vito Brugliera  
Robert Chen  
John Durant  
Willis Else  
Dean Eshleman  
Donald FlemingRobert Fulyn  
Robert Gamble  
James Geppert  
Jerome Green  
Ronald Hegli  
Richard Herman  
Jerome Hershman  
Richard Hoglund  
Patricia Hutcheson  
Kathryn Jones  
James Klafta  
Miles Klein  
William KubyDonald Matschke  
Ronald Moeller  
Neil Morton  
Thomas Olsen  
James Owens  
Robert Rieger  
Mary Lou Stanfield  
Tony Strecok  
Richard Tessmer  
Hal Waite  
Robert Wheeler  
Rank Witt  
Edith Wu

(Date of initiation not given)

Jane T. **Beasley**  
 Alan J. **Bockstahler**  
 Albert **Claus**  
 Marilyn **Dixler**  
 James F. **Fegen**  
 Donald E. **Freeland**  
 Paul **Goldberg**  
 William M. **Grounds**  
 Robert S. **Hathaway**

Sheldon **Kahn**  
 Eugene King  
 Arthur A. **Krawetz**  
 Richard Leach  
 Harold Leidecker  
 Robert Leigh  
 Donald Malm  
 Ann Morrison

Boris Musulin  
 Carl F. Samuelson  
 Donald Shultz  
**Alan C. Skinrood**  
 Walter W. Stone  
 Harvey E. **Wahls**  
 C. Charles Welch  
 Daniel Wilson  
 John **Zimmerman**

KANSAS ALPHA, The University of Kansas  
 (May 6, 1952)

Norman Baumann  
 Melville Evans  
 O. John **Gerrits**

William D. **McGinn**  
 Isaac Namioka  
 Prom Panitchpakdi  
 S. S. **Shrikhande**

**Kjersti Swanson**  
 Jerry Wackerli  
 Roy G. **Woodle, Jr.**

KANSAS BETA, Kansas State College  
 (Date of initiation not given)

Joseph A. Bukowski  
 Ervin R. Deal  
 Donald H. **Firl**

**Vahe** Keshishian  
 Herald W. Kruse

Gerald M. Smith  
 Henry **Unruh, Jr.**  
 Thomas K. Witt

KANSAS GAMMA, University of Wichita  
 (December 5, 1951)

**Gynith Giffin**

Dale S. **Krasser**

(April 25, 1952)

Lloyd L. Brown  
 Don H. **Byers**  
 Glen E. **Conklin**

John **Dahler**  
 Richard G. Holmes

Clyde E. Miller  
 Walter W. Strohm  
**Davil L. Underhill**

LOUISIANA ALPHA, Louisiana State University  
 (May 1, 1952)

Lloyd Aquillard  
 Lewis E. **Batson**  
 John Coon  
 Benjamin Craft  
 Frances **Dutsch**  
 Kay Davis  
 Robert Griffin  
 Jack R. Hall  
 Mary Jane **Hanford**

**Tildon** Hebert  
 C. R. **Hibberts**  
 Jack Jackson, Jr.  
 Alien Kelly  
 Carl M. Koreen  
 Frederick G. **Landry**  
 Carlyle Kuke Le Bas  
 William W. Lee

James Oliver  
 Donald A. Preston  
 Roy R. Runck, Jr.  
 Lloyd P. Savoie  
 Jacques L. Savoy  
 Jimmie D. **Sippel**  
 Roy St. Pierre  
 Grover J. Trammell, Jr.  
 Van C. Vives

November

## 1952 INITIATES, ACADEMIC YEAR 1951-1952

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MICHIGAN ALPHA, Michigan State College  
 (November 13, 1951)

Homer R. Arthurs  
 Herbert S. **Eleuterio**  
 Harrison C. Fisch  
 Russell Harry Fay  
 Robert E. Garner

(May 6, 1952)

**Harry N. Achziger**  
 Mary Jo **Boehm**  
 Michael **Chernjawska**  
 Frank M. **dark**  
 Gene R. **Cudney**  
 Lyle C. Davis  
 Charles **Diaz**  
 Donald W. Earle

Sara Ruth **Eaton**  
 George W. Ficken  
 John H. **Forsten**  
 Walter L. Gessert  
 Patricia A. **Hauser**  
 Mary Ann **Hutchinson**  
 Adolph Loeber  
 Richard D. **Pruett**  
 Karl Riggs

Thomas B. Jones  
 Rodney H. Lubben  
 John Hubert Muller  
 James Edwin Monsma  
 Walter A. Reid

Clio F. **Sanborn**  
 Paul E. **Schleusener**  
 Kenneth W. **Sidwell**  
 Dorothy **Stryker**  
 Vance V. **Vanness**  
 Donald Van **Ostenburg**  
 Evan S. Williams  
 Marilyn Y. **Zweng**

MISSOURI ALPHA, University of Missouri  
 (December, 1951)

James Edward Cain  
 Clarence Edward **Henson**

David A. **Kibler**  
 Aubra Clinton **Mathers**

Kenneth R. Reichert, Jr.  
 John Porter Reid

(May 13, 1952)

**Harker** Thomas August, Jr.  
 Carl Marvin Bruns  
 Robert Paul Bruns, Jr.  
 Arthur McHarg Breipohl  
 Stanley H. Bueg  
 Robert Joe Carter  
 Dale Lindsay Cole  
 Patricia Ann Covert  
 Egon Lorenz Doering  
 Jerry James Edwards

Bill Jerome **Gangwisch**  
 James Horace **Gillian**  
 Ronald Gene Graham  
 Harvey **Wendel Greene**  
 Donald George Harris  
 Harold Alexander **Heckart**  
 Phyllis Ann Heyssel  
 William Terril Higdon  
 Carl William Johnson  
 Robert James **McCloud**

Lawrence Donald **Meyer**,  
 Tom M. Noel  
 Harriet M. **Phillips**  
 John William Reed  
 George Alien Saum  
 Stanley Reed **Scruby**  
 Elmer Erwin Strehly  
 Howard Keith Stumpff  
 Robert G. Veltrop  
 Howard Wayne **Wicklein**

MISSOURI GAMMA, St. Louis University  
 (Spring, 1952)

Robert Allison  
 Francis J. **Babka**  
 William J. Best  
 John D. Blanton, S. J.  
 Sr. Francis E. **Bolk**  
 Robert W. **Boll**  
 Herman H. Bowers  
 Robert J. Breen  
 Thomas V. **Bruns**  
 Eugene Brys

Betty Ann **Ganss**  
 Maryanna Gerber  
 Francis N. Glover, S. J.  
 Robert H. Hamilton  
 John W. Hartfield  
 Glenn B. **Hoidale**  
 Anthony C. Hummel  
 Robert **Isom**  
 Paul Koichi **Ito**  
 Richard Jaeger

Howard G. Minor  
 Charles W. **Moehle**  
 John M. **Moellenberg**  
 Kenneth Moore  
 Vincent S. **Murino**  
 St. X. **Marguerita** C. Neumann  
 Lammet B. **Otten**  
 Rev. Zachary O'Friel  
 Louis **Perrin**  
 John H. **Pfluke**

Maureen M. Burke  
 William F. Cantwell  
 William F. Carrozza  
 Donald R. Casper  
 Patricia Ann Cowie  
 Thomas A. Dailey  
 Robert M. Delaney  
 Edward A. Desloge, S. J.  
 Sr. Ambrose Devereux  
 Rev. Norbert J. Dietz  
 Robert C. Distler  
 Robert C. Doerner  
 Donald L. Ekstedt  
 Paul G. Fischer  
 Gerald A. Fleischer  
 Major James H. Fox  
 Ann Gallagher

Edward J. Jaskula  
 Joseph A. Kelemen  
 Helen Mary Kelly  
 Lynn Kerber  
 Theodore J. Klingen  
 Sr. M. Beata Knoedler  
 Michael J. Koehler  
 Charles P. Kraus  
 James J. Krebs  
 Charles A. Kribs  
 Carolyn Leadlove  
 James T. Lence  
 Francis A. Liuima, S. J.  
 C. Donald Lundergan  
 Robert L. Mandeville  
 Kenneth J. Martin  
 Hiramie T. McAdams  
 Robert McCarthy

Suz K. Padden  
 Sr. Mary Rose Rauen, OSB  
 Mackay J. Real, Jr.  
 Kenneth Reske  
 Lazaras Sabalauskas  
 William J. Sehr  
 William F. Sonderman  
 Paul Sumida  
 Harry Starr  
 Katharine M. Sweetin  
 Raymond Tolosko  
 Daniel J. Troy  
 Donald Vetrone  
 Emile J. Walcek  
 Carol Wheeler  
 Kurt Wolfsberg  
 Robert E. Wysocki, CR

**MON 1A** **WNA ALPHA**, Montana State University  
 (April, 1952)

Arthur E. Davis  
 Norman C. Davis  
 Robert S. DeZur  
 Larry C. Hunter

Rachel A. Kinney  
 Benjamin M. Kramer  
 Frank R. Marshall  
 John W. Marvin

Robert E. Pozega  
 Donald J. Schaff  
 Maynard B. Stevenson  
 Paul G. Tschache

**NEB:** **KANSKA ALPHA**, University of Nebraska  
 (January, 1952)

Charles B. Ackerman  
 Arnis R. Aumalis  
 John H. Blazek  
 Dean T. Buckingham  
 Emerson Jones

John J. Lliteras  
 John A. Marks  
 Herbert A. Meyer  
 Thomas A. Reed  
 Marvin B. Rhodes  
 William L. Sawrey

Robert C. Tefft  
 John T. Warren  
 Dale R. Winder  
 James C. Wolford  
 David P. Sheetz

(May, 1952)

Roscoe Ludwig  
 Coleman Logan  
 Jean Loudon  
 Margaret McCoy  
 Duncan B. McGregor

David Moomaw  
 Maurice Mullen  
 Rita L. Stout  
 Joe B. Warner

**NEW HAM.**

**NHOSKIRE ALPHA**, University of New Hampshire  
 (December 12, 1951)

C. Webster Boodey  
 Stanley Bukata  
 Frederick Cunningham,  
 Robert B. Davis

Herbert Dickson  
 Stewart B. Hobbs  
 Robert Hux

John Oberti, Jr.  
 John Haner Perry  
 Gordon Rice  
 Walter Stapleford

**1952** **INITIATES, ACADEMIC YEAR 1951-1952**

(May 13, 1952)

William Andrews  
 Richard C. Austin  
 Cornelia L. Cahill  
 Harold J. Clark

Carl Johnson  
 Alfred E. Landry  
 William D. Peterson

Arthur Petrou  
 Harrison E. Radford  
 Rodman S. Schools  
 Olaf C. Trulson

**NEW YORK ALPHA**, Syracuse University  
 (December 15, 1951)

Alan A. Bloom  
 Werner J. Beyen  
 Frank E. Butler  
 Donald M. Casper  
 Sergei Cherniowsky  
 Kebbeth Clum  
 Ernest O. Codier  
 Naomi Cohn  
 Kenneth S. Dewire  
 William F. Doehner  
 Robert Elias Ehrlich  
 Joan Farber

Robert E. Fishlock  
 Marcel P. Fraser  
 Kenneth E. Gabel  
 Edward Glazier  
 Elaine Goldberg  
 Wallace Graves  
 Nis Hansen, Jr.  
 John Hower, Jr.  
 Stanley Kapuscinski  
 Virginia Keledjian  
 John Klein  
 Ruth King

Leo A. Magnani  
 Alan Meltzer  
 Joseph Ontko  
 Edward Perry  
 Frederick Picut  
 Lawrence Port  
 Lewis Simonoff  
 John Slayton  
 Spencer A. Weiler  
 Charles R. Willis  
 Benjamin Wu  
 Howard Zimmerman

**NEW YORK BETA**, Hunter College  
 (Fall, 1951)

Ethel Censor  
 Marie Chiarito  
 Marilyn Factor  
 Rosalie Fasulo

Eleanor Marsico  
 Dorothy Meleski  
 Antoinette Moreno  
 Arlene Moskowitz  
 Jean Moskowitz

Marilyn O'Connor  
 Nilda Torresola  
 Clemmy Zagni  
 Marcia Zimet

**NEW YORK GAMMA**, Brooklyn College  
 (Fall, 1951)

Laura Somma Chiarulli  
 Naomi Cohen  
 Kenneth Geller  
 Joseph Gruenbaum  
 William J. Judge  
 Erving Katz

Martin E. Lean (Prof.)  
 Jeremy Lifsey  
 Ruth Miller  
 Rosaline Pekarowicz  
 Edward Porto  
 Audrey Riemer

Walter Rubin  
 Max Sissman  
 Ann Ugelow  
 Jack Yahia  
 Frank Zaretsky  
 Israel Zuckerman

(Spring, 1952)

Bernard Alonik  
 Victor Bach  
 Joan Becker  
 Selma Braverman  
 Jacob Enoch

Benjamin Gross  
 Norma Gross'  
 Louis Libelo  
 Alien Morton

Samuel Oelbaum  
 Melba Phillips (Prof.)  
 Donald Solitar  
 Vivian Stark  
 Claire Wasserman

NEW YORK EPSILON, St. Lawrence University  
(Fall, 1951)

Stuart Collins, Jr.  
Donald Hastings  
Margaret Hoose

Anthony Lucca  
Hugh O'Neil

Bernard Silkwowitz  
John Taylor  
George Van Wyck

NORTH CAROLINA ALPHA, Duke University  
(November 15, 1951)

Frederick P. Brooks, Jr.  
Bruce Mylrea

Donald H. Rutter  
Frederick Sarles, Jr.

Gilbert Sward

OHIO BETA, Ohio Wesleyan University  
(November 16, 1951)

John N. Cole  
Jack E. Cornett

Robert H. Schwinn  
John F. Shuster  
George Stankievich

Elliot L. Swanson  
Shizuo Takata

OHIO GAMMA, University of Toledo  
(Spring, 1952)

Frank C. Sherburne, Jr.

Lois Crew

Carol Garn

OHIO DELTA, Miami University  
(November, 1951)

William Herrmannsfeldt  
Richard Hopper

Carolyn Jerreris  
Geraldine Lytle  
Helm B. Roberts

John Sinai  
Frederick G. Werner

OKLAHOMA ALPHA, University of Oklahoma  
(April 18, 1952)

J. C. Albright  
A. C. Atkins  
Charlotte A. Carpenter  
B. G. Casteel  
M. L. Chatkoff  
T. R. Coleman  
J. O. Danley  
W. R. Davis  
J. T. Day  
M. E. Drummond, Jr.  
R. A. Elms  
L. O. Erwin

R. A. Gibson  
B. T. Goldbeck  
J. H. Hill  
B. G. Hodges  
H. E. Hoffman  
W. R. Holden  
P. D. Kenan  
Jack Kline  
Whit Marks  
R. G. McIntyre  
Mary H. Miller  
D. L. Patten

S. K. Penny  
R. M. Rhodes  
W. W. Rogers  
J. L. Terneus  
J. D. Thomas  
J. E. Urban  
Jane A. Varga  
R. E. Vesley  
G. R. Vick  
E. G. Watkins  
J. K. Whithaus  
A. H. Woollett

OKLAHOMA BETA, Oklahoma A. and M. College  
(Date of Initiation not given)

Edward M. Barnes, Jr.  
Frank F. Dyer  
Glenn R. Elliott  
Tom P. Gilmer, Jr.  
Ronald G. Henry

Paul Langford III  
Samuel E. Loy III  
Frank W. Manley  
Gene W. Marshall  
Normal L. Martin

Helmo Raag  
Richard John Robinson  
Virginia Smith  
Alan H. Stahl  
Roger W. Williams

OREGON ALPHA, University of Oregon  
(May, 1952)

Younis Abood Al-DoorI  
Charles Edmond Aull  
Dennis Warren Barnum  
Melvin Leroy Blevens  
Richard Arthur Bray  
Shirley Ann Burr  
Gunning Butler, Jr.  
Craig Jennings Canfield

Richard Chaffee  
Forrest Garland Easton  
John Frederick Endicott  
Edward Roy Gammon  
William Sidney Harris  
Carl Frederick Jensen  
Darrel Glen Littlefield  
Granville E. McCormick

William James Mikkelsen  
Wayne Milton Parpala  
William John Reeves, Jr.  
William Leroy Roach, Jr.  
Norman Kent Sowards  
Junes Philip Wade  
Christopher Williams  
Richard Clyde Zimmerman

OREGON BETA, Oregon State College  
(Fall, 1951)

Richard Bredemeier

Harold Johnson

Adrian Wenner

PENNSYLVANIA ALPHA, University of Pennsylvania  
(Spring, 1952)

Louis Reed Baker  
Walter Byck  
Robert Charles Gebhardt  
Joan Goldman  
Geneva Grosz  
Joseph J. Higgins  
Barbara Bender  
Allan Gellert

Samuel Hoffman  
Doris Holzman  
David Kaufman  
Arthur Kraiman  
Yale Jay Lubkin  
Bernard Margolis  
Norman Indictor

Lewis Nosanow  
Joseph C. Mayer  
Albert Mildvan  
Anthony Monaco  
Violet Simmons  
Malcolm Sitkoff  
Rank Shallcross  
Yonynah Schub

PENNSYLVANIA BETA, Bucknell University  
(Date of initiation not given)

Charles Ackmar  
Leonard H. Ahlfeld  
Fred Beers  
Isabel Beers  
Marjorie Boote  
Betsy Conklin  
Norman Fretag

Joseph A. Gobbo  
Richard W. Greiner  
Richard H. Klemm  
Robert D. Larrabec  
James J. Loughney  
W. N. Lowry, Jr.  
John P. Jackson  
W. W. McClaren, Jr.

James A. Smith  
John L. Storch  
Bernard Tostanoski  
John Walker  
James R. Willson  
Francis Williamson  
William L. Wolfe

**VIRGINIA ALPHA**, University of Richmond  
(Date of initiation not given)

Catherine Bell  
Jane **Cather**  
Bertha **Cosby**

Janet R. Johnston  
**Maxine** Lindsay  
Thomas J. Little

Frank A. **Lowman**  
**J. C. Mills**  
J. S. Phillips

**WASHINGTON BETA**, University of Washington  
(Fall, 1951)

E. C. Ash, **Jr.**  
John E. Barger  
John W. **Benoit**  
Robert L. Bivine  
James H. Brown  
William J. **Bruce**  
**Lingurn H. Burkhead**  
Anthony V. **Domandich**  
Samuel S. Ellis  
**Verna L. Engstrom**  
Jay A. **Erickson**  
D. Jackson Farmer  
Frederick H. Fisher

Clyde Hudson  
John L. Jaech  
William Johnson, **Jr.**  
**R. B. Kleburz**  
William T. King  
Dan W. **Kingery**  
**Stuart E. Levell**  
Earle H. **MacCannell**  
Clarice **MacDonald**  
**T. J. Matsui**  
Leston W. Miller  
E. Wayne **Rawlings**  
Richard R. Reeves  
Olney R. Perry

Marcus H. **Petersen**  
Wesley A. Robinson  
**Burnett** H. Sams  
D. Andrew Schew  
Lyle S. Stokes  
Jack B. Stutesman  
Winston G. Walker  
Edward T. **Weng**  
David H. White  
Kathleen White  
A. Lewis Wilson  
Sylvia Vopni  
John W. Zevenbergen

(May 8, 1952)

Lester B. **Aldridge**  
Harold F. Anderson  
George H. Allen  
Charles **Ballantine**  
Stanley N. Barker  
**Sing-Tsze** Bow  
Charles H. **Brockaway**  
Sat Pal **Chhabra**  
Mark P. Freeman  
James R. Grover

Yutaka **Izumi**  
Albert C. Jones  
Walter D. Jones  
Glen H. Keitel  
Henry C. **Kreide**  
Tamami **Kusuda**  
James C. **Li**  
Victor A. **Madsen**  
Leo J. St. Jean  
Donald R. **Truax**  
Leo **Helser**

Donald R. **Lockner**  
Robert M. Kalbach  
Roger A. **Vail**  
**Malcolm D. Woodard**  
Hugh **Noland**  
Charlotte Jackson  
John R. Penning, Jr.  
Alvin P. **Hjorten**  
Robert L. Cooper  
Eugene H. Lehman, Jr.

**WISCONSIN ALPHA**, **Marquette** University  
(November 26, 1951)

John Beamish  
Dominic **Biagioli**  
Luther W. **Graef**  
Joseph T. **Hanley**  
Bernard F. **Heinrich**

Robert J. **Herzberg**  
John **Kischefsky**  
Robert O. **Nimtz**  
Wayne A. Robins  
Alfred **Rynning**

Eugene **Schmit**  
Addison D. Smart  
Donald V. **Starich**  
William J. Weiss  
David D. **Zak**

(May 17, 1952)

Robert C. **Acheson**  
Charles W. **Jahncke**

**Mary Ann Steep**

**Joseph E. Lema**  
**John J. Poklar**

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