

PI MU EPSILON JOURNAL

THE OFFICIAL PUBLICATION OF
THE HONORARY MATHEMATICAL FRATERNITY



VOLUME 1

NUMBER 7

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OF THE HONORARY MATHEMATICAL FRATERNITY

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CHAPTER REPORTS, NEWS ITEMS, etc., should be addressed
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PI MU EPSILON JOURNAL is published semi-annually at
Syracuse University.

SUBSCRIPTION PRICE: To Individual Members, \$1.50 for 2
years; to Non-Members and Libraries, \$2.00 for 2 years. Sub-
scriptions, orders for back numbers and correspondence con-
cerning subscriptions and advertising should be addressed to
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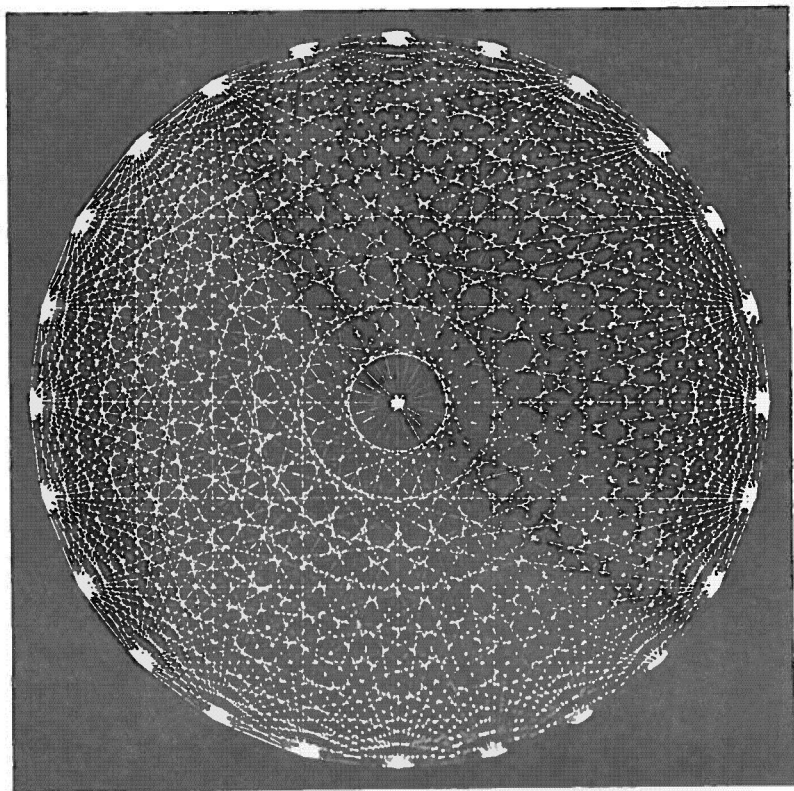
NOVEMBER

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 average 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 **Schnecken-**berger (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

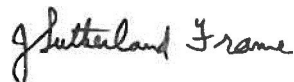
on hand in the national treasury as of June 30, 1952. from which an estimated \$500 will be disbursed to pay travel allowances for delegates and other expenses of the national meeting.

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

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 Schneck-enberger.

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.

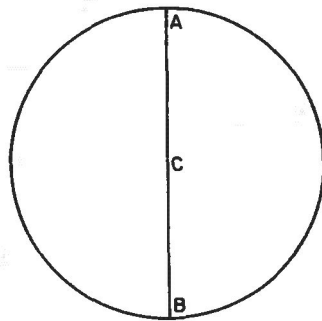
Room 221, Physics-Mathematics Building

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

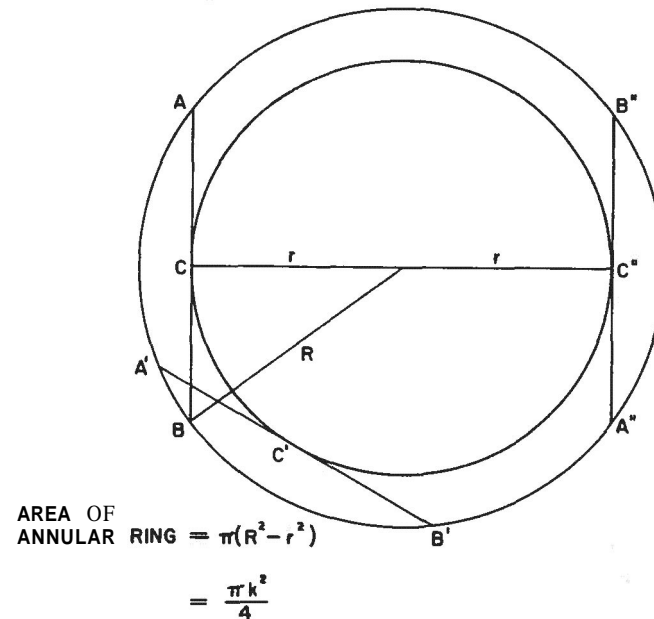
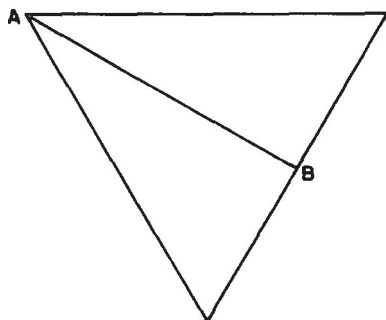


FIGURE 2

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.

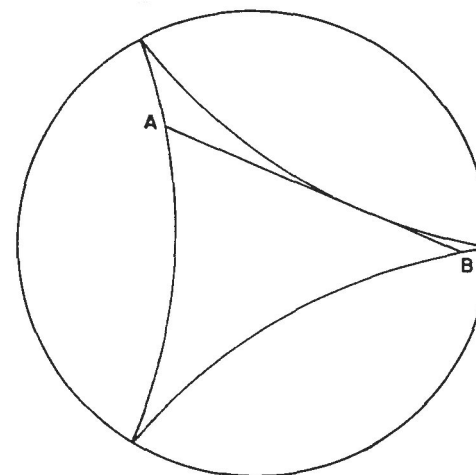


$$\text{AREA INSIDE TRIANGLE} = \frac{k^2}{\sqrt{3}}$$

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

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.



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

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

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:

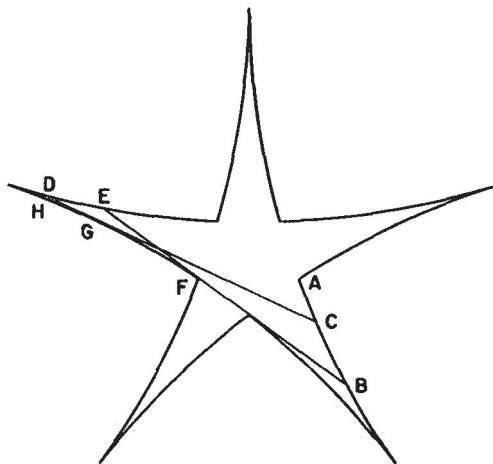
$$(x^2 + y^2)^2 - 2kx^3 + 6kxy^2 + \frac{18k^2}{16}(x^2 + y^2) = \frac{27k^4}{256}.$$

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, Takeya, 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 n th

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.

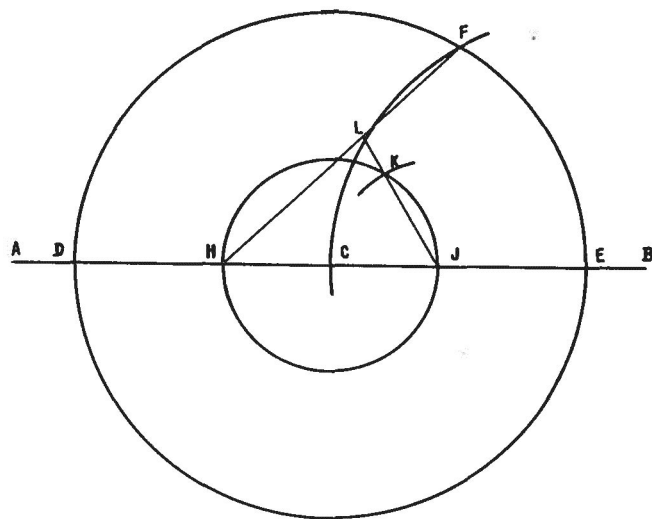


Figure for No. 6, by Bankoff

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 ± 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 ≥ 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 $S(\frac{1}{2}) < \frac{1}{2}$, 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

$$p/q = AM/MA' = AN/ND = 2AN/NB$$

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 :

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

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."

*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. Eider 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, "Imbedding 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 Σ_{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 orthonormic 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 equals x plus y plus 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, Tulio 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" (illustrated with Kodachrome slides) by Dr. Herman **Branson**

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

"**A** property of sequences" by Dr. David Blackwell

"**Toeplitz** matrices" 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" by Dr. Paul K. Rees

"Giant brains" 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", 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 Golonski 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. Goldman
Vice-Pres.	Alan Goldman	Joel Lebowitz, Irving Katz
Secretary	Martin Milgram	Laura Chiarulli
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** Hoffman 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*" and "Fourier series" by Paul Cohen

"Lattice theory" by Joseph Sucher.

*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 Phys-
ics-Mathematics Bldg., Michigan **State** College, East Lans-
ing, Michigan

Councilors General:

Professor S. S. Cairns, Department of Mathematics, Uni-
versity of Illinois, **Urbana**, Illinois

Professor **Tomlinson** Fort, Department of Mathematics, Uni-
versity of Georgia, Athens, Georgia

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

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

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

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

Corresponding Secretaries¹
1952 - 1953²

- (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 Ramage, **Jr.**, Dept. of Mathematics
- (52) District of Columbia Alpha, 1951, Howard University, Wash-
ington 1, D. C.;
Mrs. **Andretta A. Yeldell**, 3778 Hayes St. N. E., Apt. 1

¹The name and address of the Permanent Secretary, or Cor-
responding 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.

²Number 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, **Department 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**, **Okl.**;
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, **Lewisburg**, 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. **Bentley**

Romae J. Cormier
S. **Ashby** Foote
Alfred **Goode**
Sarah Jensen

Scott **Spaulding**
Roger Wicks
Alfred W. Yonda

(Spring, 1952)

Gunnar Anderson
Rex L. **Callaway**
Gary W. **Crain**

Frances **Gaynor**
John S. Henderson
B. Pauline **Lowman**

Shirley **McCallum**
David L. **McElroy**
Mary Jo **Wiggins**

ARIZONA 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. **Grundvig**

Leland Harris
Richard C. Heyser
Martin **Hochdorf**
Gale **Holladay**
Raymond J. **Jimenez**
Paul E. **Koenig**
Gary Lotto

John O. Maloy
Ernest G. **McCray**
Stanley D. Spray
Harold E. Sweeney
Charles D. Vail
Janis J. **Zalmans**

CALIFORNIA ALPHA, University of California, Los Angeles (Spring, 1952)

Miriam **Ann Caldwell**
Jan Drent
Steve **Gaspar**
Richard Carl Gilbert

Tomo-aki Hayata
Raymond Paul **Kachelmeyer**
Luther Clark Lay

Stanley Robert **Lenihan**
Edgar Reich
Marjory Irene Thorn
Edward **Oakley** Thorp

CALIFORNIA BETA, University of California, Berkeley (May 17, 1952)

Fariborz Amini
Alexander B. Cecil
Walter L. **Dieckmann**
Robert **Donati**

Randolph Eidemiller
Lee O. Heflinger
Robert Holten
William Keating
Milton Lees

Joseph Rosenbaum
Rex Shudde
Margaret **Swanson**
Paul B. Yale

COLORADO ALPHA, University of Colorado (Date of initiation not given)

Robert **Alfred Baird**
Edmund H. Brown

Morton David Davis
Leburne Walter **Farr**
David Page Larsen

Bernard **Mozer**
Betty May **Sherba**

COLORADO BETA, University of Denver (March 12, 1952)

Donald L. Beaumont
Forrest W. **Brinkley**
Frank **Cenkovich**
James F. **DeSanto**
Arthur J. **Donegan**

Robert W. Harris
Alan **Henrikson**
Irwin J. Hoffman
George **Kinoshita**

Jim **Lindsay**
Amelia Miller
Thomas E. Mullins
Leo M. **Piecha**
Stuart L. Rieben

FLORIDA ALPHA, University of Miami (Date of initiation not given)

Edward Burger
Robert Fitzgerald

Seymour **Ginsburg**
Walter Roop
Francis S. Shay

Frank J. Shea XI
Helene D. Smith

GEORGIA ALPHA, University of Georgia (January 23, 1952)

Rubin Gotesky
Charles W. Huff

Vivian **Karanangeli**
Garnett R. McMillan

Jeannette Newton
Lawrence A. Nix, Jr.

(May 21, 1952)

Eloise Eavenson
Lois Sue Hale

Benjamin B. **McLeroy**
Roy B. Tucker

Charles Emory Willett
James Bercos

ILLINOIS 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 Fleming

Robert **Fultyn**
Robert Gamble
James **Geppert**
Jerome Green
Ronald **Hegji**
Richard Herman
Jerome **Hershman**
Richard **Hoglund**
Patricia **Hutcheson**
Kathryn Jones
James **Klafta**
Miles **Klein**
William Kuby

Donald **Matschke**
Ronald Moeller
Neil **Morton**
Thomas Olsen
James Owens
Robert **Rieger**
Mary Lou Stanfield
Tory **Strecok**
Richard Tessmer
Hal **Walte**
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 Leiendecker
 Robert Leigh
 Donald Malm
 Ann Morrison

Boris Musulin
 Carl F. Samuelson
 Donald Shult
 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 **Gerriets**

William D. **McGlenn**
 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

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

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

Halbert Frederick Gates
 George William **Hess**
 Winston **H.** Heneveld
 Bernard Jacobson

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

(May 6, 1952)

Harry N. **Achziger**
 Mary Jo **Boehm**
 Michael **Chernjowski**
 Frank M. d a r k
 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

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 **Scrubby**
 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
 Lammert 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**
 Thleordore 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. **Liulma, S. J.**
 C. Donald **Lundergan**
 Robert L. Mandeville
 Kenneth J. Martin
 Hiramie T. **McAdams**
 Robert **McCarthy**

Eva K. **Podien**
 Sr. Mary Rose **Nauen, OGB**
 Mackey J. **Real, Jr.**
 Kenneth **Resnik**
 Arzanas Sabaliauskas
 William J. **Sehr**
 William F. **Sunderman**
 Paul **Sunida**
 Harry **Starr**
 Katharine M. **Sweetin**
 Raymond **Tolosko**
 Daniel J. **Troy**
 Donald **Vetrone**
 Emile J. **Walcek**
 Carol **Wheeler**
 Kurt **Wolfsberg**
 Robert E. **Wysocki, CR**

MONTANA 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

NEBRASKA ALPHA, University of Nebraska
 (January, 1952)

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

John J. Llitas
 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)

Alfred W. Blessing
 William E. **Doole**
 Ernest E. **Haight**
 Gerald Heuer

Roscoe **Lodwig**
 Coleman Logan
 Jean **Loudon**
 Margaret McCoy
 Duncan B. **McGregor**

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

NEW HAMPSHIRE ALPHA, University of New Hampshire
 (December 12, 1951)

C. Webster **Boodev**
 Stanley **Bukata**
 Frederick **Cunningham, Jr.**
 Robert **B. Davis**

Herbert **Dickson**
 Stewart B. **Hobbs**
 Robert **Hux**

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

(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
 Q. C. **Trulson**

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

Alan A. Bloom
 Werner **J. Beyen**
 Frank E. Butler
 Donald **M. Casper**
 Sergei **Chernijowsky**
 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. **Magnanti**
 Alan **Meltzer**
 Joseph **Ontko**
 Edward Perry
 Frederick **Picut**
 Lawrence Port
 Lewis **Simonoff**
 John **Slayton**
 Spencer A. **Weller**
 Charles R. **Wells**
 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 **Pekarowitz**
 Edward Porto
 Audrey Riemer

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

(Spring, 1952)

Bernard **Alonik**
 Victor **Bach**
 Ioan 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 HooseAnthony Lucca
Hugh O'NeilBernard Silkowitz
John Taylor
George Van WyckNORTH CAROLINA ALPHA, Duke University
(November 15, 1951)Frederick P. Brooks, Jr.
Bruce MylreaDonald H. Rutter
Frederick Sarles, Jr.

Gilbert Sward

OHIO BETA, Ohio Wesleyan University
(November 16, 1951)John N. Cole
Jack E. CornettRobert H. Schwinn
John F. Shuster
George StankievichElliot L. Swanson
Shizuo TakataOHIO GAMMA, University of Toledo
(Spring, 1952)

Frank C. Sherburne, Jr.

Lois Crew

Carol Garn

OHIO DELTA, Miami University
(November, 1951)William Herrmannsfeldt
Richard HopperCarolyn Jerrris
Geraldine Lytle
Helm B. RobertsJohn Sinai
Frederick G. WernerOKLAHOMA 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. ErwinR. 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. PattenS. 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. WoollettOKLAHOMA 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. HenryPaul Langford
Samuel E. Loy III
Frank W. Manley
Gene W. Marshall
Normal L. MartinHelmo Raag
Richard John Robinson
Virginia Smith
Alan H. Stahl
Roger W. WilliamsOREGON ALPHA, University of Oregon
(May, 1952)Younis Abbood Al-Doori
Charles Edmond Aull
Dennis Warren Barnum
Melvin Leroy Blevens
Richard Arthur Bray
Shirley Ann Burr
Gunning Butler, Jr.
Craig Jennings CanfieldRichard Chaffee
Forrest Garland Easton
John Frederick Endicott
Edward Roy Gammon
William Sidney Harris
Carl Frederick Jensen
Darrel Glen Littlefield
Granville E. McCormickWilliam James Mikkelsen
Wayne Milton Parpala
William John Reeves, Jr.
William Leroy Roach, Jr.
Norman Kent Sowards
Junes Philip Wade
Christopher Williams
Richard Clyde ZimmermanOREGON 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 GellertSamuel Hoffman
Doris Holzman
David Kaufman
Arthur Kraiman
Yale Jay Lubkin
Bernard Margolis
Norman IndictorLewis Nosanow
Joseph C. Mayer
Albert Mildvan
Anthony Monaco
Violet Simmons
Malcolm Sitkoff
Rank Shallcross
Yonynah SchubPENNSYLVANIA BETA, Bucknell University
(Date of initiation not given)Charles Ackmar
Leonard E. Ahlfeld
Fred Beers
Isabel Beers
Marjorie Boote
Betsy Conklin
Norman FreitagJoseph 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. **Kiebertz**
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**
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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**
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Leo **Helser**

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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

Jospeh E. Lema
John **J. Poklar**

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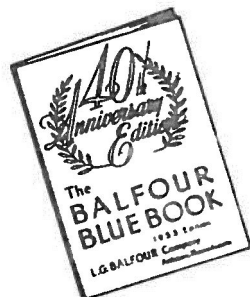
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