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PENTAGON

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    Kappa Mu Epsilon, national honorary mathematics fraternity, was founded in 1931. The object of the fraternity is four-fold: to further the interests of mathematics in those schools which place their primary emphasis on the undergraduate program; to help the undergraduate realize the important role that mathematics has played in the development of western civilization; to develop an appreciation of the power and beauty possessed by mathematics, due, mainly, to its demands for logical and rigorous modes of thought; and to provide a society for the recognition of outstanding achievement in the study of mathematics in the undergraduate level. The official journal, THE PENTAGON, is designed to assist in achieving these objectives as well as to aid in establishing fraternal ties between the chapters.

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THE MATHEMATICAL METHOD [1]

C. V. NEWSOM

Past President of Kappa Mu Epsilon

About a year ago I was seated around the dinner table with representatives of five different fields of knowledge. One member of the group, as a challenge, asked each person this question:

"What has been the most important contribution of your field to the development of civilization?"

The chemist had an answer; the psychologist had an answer; but I, the mathematician in the group, was unable to answer. In fact, I begged for time, and promised to give my answer at our next dinner meeting. In the meantime, I questioned colleagues, and I thought about many important aspects of mathematics. I considered what our civilization would be like without counting, without the notion of measuring, without the calculus, and so on. When I met the group at our next meeting I made my reply; it was: *the mathematical method*. You may disagree, but after much consideration, I have decided that the method employed and pioneered by mathematics, which now is fundamental to every phase of intellectual endeavor, probably represents our greatest contribution to mankind. This conclusion may seem strange to many of you, for we rarely study the method of mathematics as distinct from its subject matter; I think this very fact is an indictment of us as mathematicians and the courses of study that we design. More and more I think we will realize that one of the fundamental objects of the study of mathematics is to become acquainted with the mathematical method, the most important process for building systems of knowledge that man has been able to invent.

In order to discuss with you the method of mathematics, let us become students of history for a few minutes. We are all acquainted with the wonderful achievements of the Egyptians. We are now learning that the ancient Sumerians knew some mathematical facts perhaps even more remarkable than those known by the Egyptians. But Egyptian and Sumerian mathematics was little more than a practically workable empiricism; the formulas that were employed resulted from trial and error methods. No great understanding was involved, and the logical element does not appear. We hear a lot about the successes of the Egyptians and the Sumerians, but we have a tendency to forget those of their formulas and methods that produced false results.

The crude empirical methods of the Egyptians and the Sumerians were intolerable to the Greek mind. The Greek love for abstraction could not be satisfied by empirical procedures. The Greek tradition in mathematics appears to have started with the work of Thales in the first half of the sixth century, B. C. This versatile genius has been proclaimed one of the wise men of antiquity; certainly he was a worthy founder of systematic mathematics. Thales was wealthy, and traveled extensively. He brought to his studies a broad knowledge of the mathematical and scientific knowledge available at his time. Reliable ancient writers assert that Thales proved at least six propositions in plane geometry. These theorems are comparatively trivial, and certainly the proofs that were employed would hardly be recognized as logical by present standards. Nevertheless, if tradition is to be believed, Thales showed in a crude way that some geometric statements seemed to follow in a rather natural way from other statements.

Pythagoras, a disciple of Thales, lived about a half century later. It is becoming increasingly clear that Pythagoras and his pupils continued the type of study pioneered by Thales. Probably there were arguments concerning the validity of various proofs, for Pythagoras is quoted as saying that there existed a "necessity for a clear conception of proof

on which all sane mortals could agree." Hippocrates, a disciple of Pythagoras, attempted to create a chain of geometric propositions, in which each proposition seemed to follow in a natural way from earlier propositions.

Next in the sequence of great names was Plato; he was strongly influenced by Pythagorean ideas. D. E. Smith writes, "Without Thales there would not have been a Pythagoras—or such a Pythagoras; and without Pythagoras there would not have been a Plato—or such a Plato." Geometric considerations meant so much in Plato's thinking that, over the entrance to his famous Academy in Athens, he wrote, "Let no one enter who is unversed in geometry." In Plato's Academy, Theudius continued the interesting type of work started by Hippocrates by writing a treatise in which chains of propositions occurred.

Among the students at Plato's Academy was Aristotle; in fact, Aristotle sat at the feet of Plato from the age of seventeen until he was thirty-seven. A critical examination of Aristotle's works reveals how strongly he must have been influenced by the mathematical considerations in Plato's Academy. His famous system of logic, which still forms the basis for modern studies, undoubtedly resulted from his examination of mathematical demonstrations that were under discussion during his time. It was Aristotle who first emphasized that the propositions of any science are of two kinds: (1) primary propositions which are assumed, and (2) secondary propositions which are proved by logical methods from those that are taken as primary. He dismissed as utterly fallacious the notion that it is possible to prove everything; every system of knowledge starts with certain statements that are unproved within the system. This is true not only of mathematics, but of physics, psychology, economics, and zoology.

Every serious student of mathematics should study Aristotle's *Analytica Posteriora*. One paragraph from this work will show the advanced state of Aristotle's thinking. I quote:

"By first principles in each genus I mean those the truth of which it is not possible to prove. What is denoted by the first (terms) and those derived from them is assumed; but, as regards their existence, this must be assumed for the principles but proved for the rest. Thus what a unit is, what the straight (line) is, or what a triangle is (must be assumed); and the existence of the unit and of magnitude must also be assumed, but the rest must be proved. Now of the premises used in demonstrative sciences, some are peculiar to each science and others common (to all), the latter being common by analogy, for of course they are actually useful insofar as they are applied to the subject-matter included under the particular science."

After reading such a quotation from the work of Aristotle, it seems an easy step to the writings of C. S. Peirce, distinguished Harvard logician of the latter part of the nineteenth century, wherein he made the following assertions:

"Every science has a mathematical part, a branch of work that the mathematician is called in to do. We say, 'Here, mathematician, suppose such and such to be the case. Never you mind whether it is really so or not; but tell us, supposing it to be so, what will be the consequences?'

"(Mathematics) makes no external observations, nor asserts anything as a real fact. When the mathematician deals with facts, they become for him mere 'hypotheses'; for with their truth he refuses to concern himself.

"I consider that the business of drawing demonstrative conclusions from assumed premises, in cases so difficult as to call for the services of a specialist, is the sole business of the mathematician."

It is apparent from what has been said that Greek scholars constructed an excellent foundation for the mathematical treatises of Euclid. This remarkable mathematical organizer taught at the University of Alexandria in about the third century, B. C. His writing of *The Elements,* in

thirteen books, is generally regarded as the first great event in the history of mathematical organization. The influence of the work has been tremendous, and the genius of Euclid has been recognized by mathematicians of every age. Proclus, the historian and philosopher of the fifth century, A. D., wrote, "Euclid's system of Elements will be found to be superior to the rest; its clearness and organic perfection are secured by the progression from the more simple to the more complex, and by the foundation of the investigation upon common notions."

Euclid demonstrated 465 propositions, which he developed in a logical chain from a collection of definitions and ten primary propositions given at the start. The primary propositions were divided into two sets of five each, called postulates and common notions, respectively. The famous fifth postulate, which later was to be responsible for many mathematical investigations, stated that "If a straight line falling on two straight lines makes the interior angles on the same side less than two right angles, the two straight lines, if produced indefinitely, meet on that side on which the angles are less than two right angles."

The Elements of Euclid has gone through more than a thousand editions since the first one printed in 1482; before that, manuscript copies dominated all teaching of geometry. The reawakening of interest in Euclid's work during the sixteenth and seventeenth centuries had much to do with the great reformation in science and mathematics of that era. We find in every period of modern history that a critical examination of Euclid's work has always led to an improved appreciation of mathematical rigor and the proper use of mathematical techniques. Such critical examination has been necessary, for no one must think that Euclid's work was perfect. By modern standards, the methods employed in *The Elements* are somewhat crude; Euclid was merely the pioneer.

One of the early students at the University of Alexandria was Archimedes; this greatest of geniuses of the Greek

period was thoroughly schooled in the Euclidean tradition. He extended and improved Euclid's system of geometry, and applied the same scheme of organization to the field of mechanics. Although Archimedes was probably the greatest, yet he was only one of many distinguished mathematicians produced at the University of Alexandria. The final destruction of this remarkable institution in the seventh century, A. D., plunged the world into darkness, and mathematics did not recover for a thousand years. It is interesting to speculate what our civilization would be like now if by some mysterious historical magic the cultural appetite of western Europe in the sixteenth century could have followed immediately after the great mass of scientific food made available by Alexandrian scholars.

As already indicated, the modern student of seventeenth and eighteenth century mathematics observes the imprint upon the thought of that period which resulted from a renewed interest in the methods employed by the Greeks. As a specific example, Lagrange published his famous *Analytic Mechanics* in 1788; this work explicitly points out the hypotheses upon which the science of mechanics may be founded, and all other propositions of the science were derived in a logical manner from those that were assumed. Lagrange was so afraid that intuition would enter into his analysis that he even refused to draw any figures to assist him in his demonstrations.

During the seventeenth and eighteenth centuries many mathematicians showed a profound interest in the axiomatic foundation of Euclid's geometry. Euclid's fifth postulate, already stated, was the subject of much discussion. Such studies culminated in the interesting non-Euclidean geometries enunciated in the nineteenth century by Lobachevski, Bolyai, Gauss, and Riemann. These men demonstrated that Euclid's fifth postulate could not be proved from other primary propositions in the system, and, in fact, showed that distinctly different geometries resulted when the fifth postulate was replaced by the other postulates. Mathematics had

awakened to the truth of a statement attributed to one of the characters in the novel, *South Wind,* by Douglas; he said, "The older I get, the more I realize that everything depends on what a man postulates. The rest is plain sailing."

During this same period of the nineteenth century, studies in projective geometry revealed the fallacy of the idea that mathematics is always concerned with magnitude. The notion that "Mathematics is the Science of Number" has now been completely discarded. The principle of duality, likewise revealed in projective geometry, emphasized that the meaning assigned to the terms of a mathematical system is not important to its logical organization. Mathematics became increasingly abstract and, in 1844, Grassmann recognized that mathematics is a science of pure forms; it must be studied apart from its applications.

During the latter part of the nineteenth century we see a frenzy of activity as Pasch, Peano, Pieri, Hilbert, and many others became seriously concerned with the essential properties of axiomatic systems and the correct application of logical principles. The great emphasis by these men upon the notion of consistency, not truth, has introduced a perfection into modern mathematics that will long be the envy of other fields of knowledge. Without making any thorough attempt to bring this record up to the present time, I may only say that mathematics is reaching its maturity. I know this because mathematicians have now started the study of metamathematics, which is the science concerned with the methods of mathematics. "What constitutes a good primary proposition and a good set of primary propositions?" is a legitimate question for investigation. "What do we mean by a system of logic? What systems of logic are possible? How may these systems be applied?" are other questions under active consideration. If I were a young man just starting my study of modern mathematics, I certainly would not slight present studies upon mathematical logic and related matters. Mathematics, by definition, is now regarded

as the totality of hypothetico-deductive systems; the emphasis, as you see, is upon the method.

As we have seen, the method of mathematics, simply phrased, is merely that of organizing the propositions of a science into those which are primary or unproved in the system, and those which are called secondary because they are deduced from the primary statements. But there is more to the idea than is immediately apparent. For instance, the scientist imbued with the mathematical point of view will insist that the number of primary statements be reduced to a minimum. It becomes an interesting game to attempt to reorganize a scientific system so that ten primary statements, for example, might be reduced to eight, or perhaps seven or six. Even though every good scientist realizes that some propositions in his science must be accepted without proof, yet he wants to know the minimum number of assumptions essential to the construction of his system.

All of this implies, of course, that there is a continuous attempt to isolate hidden assumptions. The scientist wants to be certain that he is completely objective, which means that no conclusions are expressed except those that may be derived by logical procedures from hypotheses explicitly stated. Please note that the only definition of objectivity that can be tolerated requires the application of the mathematical method.

When a science has been organized by the use of the mathematical method, new and important conclusions are possible as additional propositions are proved. Moreover, ingenious masters of the method are sometimes able to invent new sets of primary propositions, new to the system, which lead to results equivalent to those originally present. Thus, in a sense, a mathematical organization is capable of two-way extension.

The mathematization of a natural science must never be regarded as a substitute for experiment, for experimentation is continually necessary to confirm the adequacy of any theoretical structure employed as a correlating agent in the

study of a set of natural phenomena. The deduction of a new proposition may suggest a new experiment, but any experiment furnishing results quite contrary to those predicted by theory will induce reconsideration of the primary propositions, and perhaps cause the whole system to be discarded.

As you can see, we are going deeper and deeper into philosophical considerations. In fact, we are forced to do so if we want to go farther, for natural philosophy is essentially the analysis of the relation between a theory and the set of natural phenomena it was designed to unify and explain. The modern mathematician, well versed in the mathematical method, is in an enviable position to understand the role that man can play in comprehending his physical environment. I hope many students of the future will become concerned with the philosophical implications of mathematics.

To summarize and to emphasize, I have chosen to close this paper with two important quotations. Both statements were written by men who have experienced and understand the mathematical method. The first is from the pen of G. C. Evans, and the second was written by F. G. Donnan. I quote:

"The systematization which occurs in a theoretical science, as we may properly call it in order to distinguish it from a natural or an applied science, is a process which is apt to come late in the development of a subject. Evidently some fields of knowledge are hardly ready for it, for it is typified by a free spirit of making hypotheses and definitions rather than a mere recognition of facts. But when we find this feeling for hypothesis and definition and, in addition, become involved in chains of deductive reasoning, we are driven to a characteristic method of construction and analysis which we may call the mathematical method. It is not a question as to whether mathematics is desirable or not in such a subject. We are in fact forced to adopt the mathematical method as a condition of further progress."

—G. C. EVANS.

"The power of rigorous deductive logic in the hands of a mathematician of insight and imagination has always been one of the greatest aids in man's effort to understand that mysterious universe in which he lives. Without the presence of this power, the experimental discoverer might wander in the fields and pick the wild flowers of knowledge, but there would be no beautiful garden of understanding wherein the mind of man can find a serene delight."

—F. G. DONNAN.

What we do may be small, but it has a certain character of permanence; and to have produced anything of the slightest permanent interest, whether it be a copy of verses or a geometric theorem, is to have done something utterly beyond the powers of the vast majority of men.

—G. H. HARDY.

DEVELOPMENT OF MATHEMATICS
IN SCOTLAND, 1717-1838 [1]

SHIRLEY SEARLES

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In previous years at meetings of the Michigan Section of the Mathematical Association of America, a series of papers on the development of mathematics in Scotland have been read by Dr. E. R. Sleight. The first of these papers sketched the status of mathematics in Scotland from the earliest known records to the close of the seventeenth century. The second paper examined Scottish mathematics and mathematicians from 1699 to 1746.

The purpose of this paper is to endeavor to show the development of mathematics in Scotland through its study at Scotland's famous universities, especially the University of Edinburgh, from the middle of the eighteenth century to the middle of the nineteenth century.

Of course, no professor of mathematics at Edinburgh seemed ever to live up to Colin McLaurin's achievements; but, nevertheless, after his time there still was a constant progress in mathematics there. In 1747 the man to take over McLaurin's Chair at Edinburgh was Matthew Stewart. "He was a genius of lower order than McLaurin but able and original in his own field." Matthew Stewart was born at Rothesay in 1717, and entered the University of Glasgow in 1734. Having been trained by Dr. Simson at Glasgow, he imbibed his severe tastes. In 1741, he enrolled at the University of Edinburgh to study religion; but, after hearing McLaurin, he became obsessed with the mathematical field. As an aid to his candidature for the Mathematics Chair at Edinburgh, he wrote *Some General Theorems of Consider-*

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able Use in Higher Parts of Mathematics. Among these theorems there is an important one called Stewart's Theorem, although the credit for the theorem is due to Simson. He was noted for these monuments of skill and for his success in the cultivation of the geometrical analysis of the ancients. He was extremely jealous of the encroachments of algebra on geometry, and his constant aim was to reduce algebra to geometric terms. In later life he wrote *Traits Physical and Mathematical,* which were an aid to the simplification of ancient geometric demonstration and essayed the application of pure geometry to physical questions. He also worked at and solved Kepler's Problem. One of his works written in 1756 was centered around the solution, by use of only elementary geometric principles, of this problem in Kepler's second law of planetary motion. In his lifetime, not only was he Head of the Department of Mathematics at Edinburgh and for a short time at Marischall, but he also obtained the Degree of Doctor of Divinity at Glasgow in 1756 and became a fellow of the Royal Society in 1764. In 1772, his health failed and his son undertook to teach his classes.

Two outstanding men followed Matthew Stewart in the Mathematics Chair at the University of Marischall. The first of these, John Stewart, held his position at Marischall for forty years and the Chair of Natural Philosophy at Edinburgh for seven years. He was belovedly called John "Triangles" by his students. Particularly was he known for his strong influence on university teaching; he contributed materially to the production of an intellectual group of teachers of mathematics, for he very keenly felt the need for more teachers with better academic training. When he died, the loss to his family was so great that his wife and eldest daughter followed him within the same week. However, he left some very original works. He was thoroughly versed in the writings of his predecessors and extended their results in many directions. Among these works are a translation of Newton's *Quadrature of Curves,* and the *Analysis of Equations of an Infinite Number of Terms.*

The second man was William Trail. He has been called "the last of the Fathers of Scottish Science." From 1759 to 1763 he was a student at Marischall and then received his M. A. at Glasgow. While at Glasgow in 1766 he was on intimate terms with Simson who influenced his thinking a great deal. He held the Mathematics Chair at Marischall for only three years, after he had defeated the candidates, Playfair and Hamilton. He finally resigned in 1799 on obtaining preferment in the Irish Church and, after taking on clerical work for fifty years, he died at the age of eighty-five in Bath, England. His original written material in mathematics were *Elements of Algebra for the Use of Students in Universities* and *Life of Simson,* whom he knew so well. This biography wasn't exceptional, but it contained extensive information on Simson and his geometrical studies.

Back at Edinburgh, Dugald Stewart, Matthew Stewart's son, taught for his retired father and took over the Chair officially after his father's death in 1772. He was known as an excellent teacher in name and reputation. He was also a member of the Department of Mental and Moral Science. His climb to a professorship was very rapid, being in high school at the early age of eight, at the university at thirteen, and at Glasgow at eighteen. Time and time again he said his teachers had made him. They had given him his strong literary and classical knowledge which was often blended with eloquence and a great philosophy. He was inclined to topics, like Ferguson, between mental science and jurisprudence. He became a follower of Reid's system, always retaining a clear mathematical mind. Lord Cockburn said, "To me his lectures were like the opening of the heavens." Finally in 1805, Dugald Stewart gave up the Mathematics Chair and devoted his time exclusively to Moral Philosophy and some political economics. He wrote extensively and it is said that his "classroom was the cradle of the *Edinburgh Review.*" The strongest of his aims was to stem the flow of skeptical publications from the Continent. It was a great

loss to the world of mathematics and philosophy when he died in 1828.

John Playfair contributed much to the development of mathematics, as is shown by the extensive material found in the history of the subject. During his time mathematical outlooks began to change. Born in Forfarshire in 1748, he was educated at the University of St. Andrews. While a student there, he delivered lectures for the Professor of Natural Philosophy. As a candidate for the Chair of Mathematics at Marischall and for Natural Philosophy at St. Andrews, he was unsuccessful. So, he became a parish clergyman, living at Lief and Bernie. His friendship with Maskelyne was a fortunate thing, for through him Playfair was introduced to the science circles in London. He became joint head of the Chair of Mathematics at Edinburgh, was general secretary to the Royal Society for years, and then transferred to the Natural Philosophy Department at Edinburgh in 1805. He considered this Chair as giving him more freedom and learned leisure. He gave only one lecture a day, reading every word. The remainder of his time was spent in research and writing. In 1812, as president of the Astronomical Institute, he was instrumental in the completion of Calton Hill. Calton Hill is in the city of Edinburgh and contains one of the oldest telescopes now in existence. This instrument is still being used after all these years. In 1816 and 1817 he took a leave of absence to observe Mont Blanc. Sir Christeson said he was "a charming teacher, so simple, unaffected," and Lord Cockburn spoke of him as being "admired by all men." John Playfair was disappointed all his life at the neglect his contemporaries paid to the many mathematical advances made on the Continent. He was absolutely struck with the backwardness of the English in adopting continental analyses. Therefore, he set himself the task of "diffusing among his countrymen a knowledge of the progress which science had been making abroad" through:
(1) the *Encyclopaedia Britannica;* (2) papers in *Transac-*

tions; (3) articles in the *Edinburgh Review*; and (4) class teaching.

His chief merit in writing, of which he did a great deal, was not as a discoverer of pure mathematics. He wrote an *Essay on the Arithmetic of Impossible Quantities, Causes Which Effect Accuracy of Barometrical Measurements*, and an edition of Euclid's *Elements*, now used in some schools.

He became famous as the first "encyclopaedist," reviving the History of Science in a *Dissertation on the Progress of Mathematical and Physical Sciences*. He also wrote *Lives*, a biography of Matthew Stewart, Hulton, and Robison. All of these were written with "immense scientific erudition, a calm intellect, and clear style." It is said that his efforts were aimed at broadening "the outlook of mathematicians and arousing an interest in the historical development of science."

The son of the Minister of Logieroit, Adam Ferguson, was destined to hold a joint position as head of the Mathematics Department with Playfair, and also be head of the Department of Moral Philosophy and Natural Philosophy. In fact Cleghorn marked him for the Moral Science Chair in his words, "He has my dying voice." He had taken the arts course at St. Andrews and also trained for the church at Edinburgh. However, after a few years as chaplain, he determined to relinquish the ministry because he thought he lacked the necessary qualities. Ferguson then established himself at Edinburgh in a succession of chairs from co-head of mathematics to moral philosophy, to natural philosophy.

Ferguson was a man of quick decisions, and in 1774 he became tempted to travel with the Earl of Chesterfield. After asking for a leave and being refused, he left anyway. When he returned, because of the different and unusual attitudes of those times, with the help of his friends and the Court of Sessions, his reinstatement was compelled. In 1778, he went on another expedition to the Continent under negotiations with the State Congress. He returned in two years and became stricken with paralysis. After many years of

treatment under Professor Black, a relative, and living on a Pythagorean diet and swathed in furs, he recovered only to die in 1816. In his lifetime he brought his study of men in groups and his consideration of the progress of whole societies to the public eye. This unusual outlook is now called "Sociology." Being interested in sociology and, as Cousins said, a moralist above all his predecessors, he was bound to affect the mathematics and the other courses he taught, placing them all on a higher plane.

John Leslie, the next holder of the Chair at Edinburgh, was considered odd by his contemporaries, as are all who are born before their time. Originally he was a native of Fife and a student at St. Andrews, finishing his education with James Ivory at Edinburgh. Then he began tutoring mathematics to the Wedgewood family and writing in science journals. In 1800 he wrote a description of his invention and contribution to physics, the differential thermometer. In 1804 Leslie's *Essay on the Nature and Propagation of Heat* was published and was destined to cause him a great deal of trouble in later life. He became a candidate for the Chair of Mathematics at Edinburgh in 1805. This caused quite a stir in the Edinburgh society and the General Assembly of the Church. MacKnight of the Presbyterian ministry was the candidate for the opposition, who said they had discovered heterodox tendencies in Leslie's article on heat. He, of course, disclaimed these inferences. On Leslie's side was Playfair, who didn't want the clergy to interfere with appointments to the Mathematics Chair. Leslie won a victory in the Town Council. This victory proved to be of great benefit to many of his successors. The Presbytery still wanted a voice and applied to the Court of Sessions, but failed to achieve any success, causing a dispute in the Assembly for two days. In spite of all this opposition, Leslie held the Mathematics Chair for fourteen years and later became the Professor of Natural Science in 1819.

John Leslie was fired with many brilliant ideas. He proposed a special physics class which was turned down. In

1826 he succeeded in giving popular lectures in the summer to a group of mixed classes. This brought about unseemly results; the Senatus protested that this class was unsuitable to the dignity of Edinburgh, and the Town Council permitted it only for one session.

In spite of the many people who considered John Leslie as queer and undignified, he became knighted in the Guelphic Order in 1832 because of the recommendation of Lord Brougham.

Professor Leslie was of the school of Simson and Matthew Stewart. His joy was in the field of geometry; he wrote *Geometry,* with an appendix on geometrical analysis. "In erudition he was scarcely inferior to Playfair" either in his *Philosophy of Arithmetic* or in his *Dissertation on the Progress of Mathematical and Physical Science,* although his writing was rhetorical and slightly exaggerated. So, John Leslie has gained a place for himself in the pages of mathematical history in spite of his, or, if you prefer, because of his perverseness and eccentric mannerisms and appearance, an appearance sometimes compared with Sir John Falstaff.

William Wallace was next to succeed to the Mathematics Chair from 1819 to 1838, in preference to Babbage. "He was a self-educated and self-made man." Among his many jobs can be listed book-binder's apprentice, warehouseman, shopman to bookseller, mathematics tutor, master in Perth Academy, professor of Mathematics at Sandhurst, and Ivory's colleague. As Head of Mathematics at Edinburgh, he was able and popular. However, he had a narrow side, characteristic of the times, which was seen in 1828 when he moved the Senatus to represent to the Town Council that the establishment of high school arithmetic and mathematics would injure the Mathematics Chair at the University. He was a fruitful writer on mathematical subjects, writing for the fourth edition of the *Encyclopaedia Britannica* and contributing theorems to pure mathematics. Also he invented the erdograph.

The first Englishman of entirely English education appointed to the Mathematics Chair at Edinburgh was Phillip Kelland. He was the son of an English clergyman and was in the Episcopal Orders. He became Senior Wrangler, First Smith's Prizeman at Cambridge, and a tutor at Queen's College for three years.

He was extremely successful at Edinburgh, a good teacher and very beloved. He identified himself with the Scottish University system, "recognizing the merits and depreciating reform that would interfere with its essential character." Never tiring of working for education in Scotland, for to him it was a labour of love, he became Examiner of Schools under the Dick Bequest and Secretary of the Senatus Academicus. Kelland was a kindred spirit with Principal Lee whom he liked. He was a model type of academic figure, pleasant, thorough, and a savant of high calibre too, "promoting science in remote attitudes." He wrote papers which were read to the Royal Society of Edinburgh. He also contributed to the physical science investigation of the motion of waves in canals, and to physical optics. William Wallace edited and reprinted Young's *Lectures*. In the field of pure mathematics he wrote "Memoir on the Limits of Our Knowledge Respecting the Theory of Parallels"; and an algebra text, a rational account of the first principles of algebra. In collaboration with Professor Tait, he wrote an elementary treatise on the subject of quaternions.

"He died in harness, like a general in the hour of victory." Six months before his death he was elected President of the Royal Society at Edinburgh, and a fortnight before his death he gave a Promoter's Address to the art graduates in the University.

Thus in the closing years of the eighteenth century and the early years of the nineteenth, Edinburgh and all of Scotland took an active and enlightened interest in science and mathematics. The Royal Society was a center for such interest.

In the universities of Scotland other than Edinburgh,

the atmosphere and attitude toward these subjects seemed to be unfavorable because of too much interest in administration and financial troubles. However, some advancements were being made and the level of attainment was high. Schools did offer courses on conic sections and elementary calculus. Their presence indicates a new teacher outlook for the student. In all the universities, there was a lack of preserving balance in studies.

Also, science in Scotland was considered a possession of one nation. This was a drawback. Not enough notice was taken of analytical methods, and a long neglect of calculus, except in the purely Newtonian form, was detrimental. However, in spite of the slowness and the perverseness of man to accept the new, time is a relative thing and advancement and progress in Scotland was made during these years, for the people began to see a real need for mathematics. As Bacon, in his famous essay "Of Studies," said, "So if a man's wit be wandering, let him study the mathematics."

BIBLIOGRAPHY

The Dictionary of National Biography, Vol. XLIII. London, Smith Elder and Company, 1909.
The Encyclopaedia Britannica.
Sir Alexander Grant, *The Story of the University of Edinburgh*, Vol. II. London, Longmans Green and Company, 1884.
Proceedings of the Edinburgh Mathematical Society, Vol. I.

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Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture.   —BERTRAND RUSSELL.

A PLEA FOR NON-ISOLATIONISM IN MATHEMATICS[1]

VICTORIA FRITTON

Mount St. Scholastica College

About the middle of the seventeenth century there began an increased study of the natural sciences which historians have referred to as the scientific revival. From some points of view it may be regarded as a period of decline—a decline for mathematics—for it was during this period in history that mathematics started its downward trend toward the field of academic isolation. This trend continued slowly until, at the turn of the nineteenth century, it had become almost completely an isolated science. You may ask what are the reasons for this decline to isolationism.

Before I answer the above question, I shall clarify my interpretation of the term isolationism, and in so doing exercise the mathematician's privilege to set up his undefined terms. By isolationism I mean an overemphasis on the practical side, or as it is commonly known, applied mathematics. This has caused a regrettable underdevelopment of pure mathematics, which, in turn, is responsible for the lack of emphasis on a philosophy of mathematics and its first principles. The result has been a withdrawal of mathematics from its rightful place in relation to the other fields of knowledge.

As I see it, the principal reason for the decline of mathematics was the scientific revival itself. You will probably object that this same period of renewed interest in and development of the positive sciences is known as the Golden Age of Mathematics, and therefore why was it a period of

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decline? I agree that in the beginning of the era it did look as if mathematics were developing into a Golden Age. However, with the relentless flood of scientific discoveries, mathematics was overworked in order to keep scientists supplied with new, workable methods and mathematical interpretations. Most of these new methods were themselves so involved that to make them practicable mathematicians had to dispense with the theory behind them in order to prepare students with the mechanical knowledge necessary for them to take their place in the world of science. In so doing, it slowly defeated its own purpose.

A second reason for the decline is the prevalent notion that the theory of mathematics, since it has no practical application, is useless and not of sufficient importance in itself to be taught. Even some of our greatest mathematicians have been guilty of this error.

However, the primary impulse behind mathematics is *not* its utility but its ability to satisfy man's intellectual curiosity and to furnish a rational, though limited, explanation of intelligible things. That it satisfies intellectual curiosity is evidenced by the many mathematical tricks and puzzles whch are regarded by great thinkers merely as amusing pastimes. Such was the status of Pascal's and Fermat's mathematical theories of probability long before any practical application of them was made. This inherent property of mathematics to excite intellectual curiosity and to develop one's mind is recognized by those who have had no formal schooling. One of the greatest thinkers of our own country realized this fact; Abraham Lincoln mastered the six books of Euclid, not for their practical value, but to develop his mental faculties. Secondly, the ability of mathematics to furnish a rational explanation of intelligible things is constantly proved by the fact that thinkers periodically develop mathematical philosophies of the universe. Outstanding among these philosophies are Pythagoras's theory that number rules the universe, Leibniz's monad theory, and Sir James Jeans's conclusion that the final truth

about a phenomenon resides in the mathematical description
of it.

Poincare, the last universalist, was so-called because he
was the last man to coordinate all mathematics, both pure
and applied. He recognized the trend towards isolationism
and voiced his plea for a return to the philosophy underlying
mathematics in the words, "I have spoken ... of our need to
return continually to the first principles of our science and
of the advantages of this for the study of the human mind..."
Continuing, he states that this need has inspired recent de-
velopments in mathematics along this line.

These developments are today embodied in the three op-
posing schools of thought prevalent in modern mathematics;
the logistic, formalist, and intuitionist schools. Some writers
mention a fourth school, the postulational, but this is too
closely allied to the first two to merit separate consideration.
The three schools are opposing because the formalist denies
the logistic and attempts to controvert the conclusions of the
intuitionist. Though all three are difficult to grasp, the
logistic is most easily understood.

The logistic school, of which Bertrand Russell is the
chief exponent, has its basis in symbolic logic. As outlined
in his *Principles,* part of Russell's program is "to prove that
all mathematics deals exclusively with concepts definable
in a small number of fundamental logical concepts..." In
short, the logistic school holds that mathematics is a branch
of logic and by strict adherence to its logical concepts and
deductive reasoning they hope to arrive at the whole of
mathematics. Russell himself claims that "it has now be-
come wholly impossible to draw a line between the two
(mathematics and logic); in fact, the two are one. They
differ as boy and man: logic is the youth of mathematics
and mathematics is the manhood of logic."

That school which advocates formalism is very difficult
to analyze. It has developed from David Hilbert's philos-
ophy of mathematics in which Hilbert adopted the postula-
tional method of the Greeks and went even farther by de-

manding that the set of postulates to be used must be proved self-sufficient. This seemingly impossible demand and the resulting efforts to satisfy it have caused this school to be termed a fanciful game played according to certain simple rules with meaningless marks on paper. However, the real purpose of formalism is to render the logical structure of mathematics more secure by making it more definitely objective.

Directly opposed to the formalist school is the intuitionist school, represented by Brouwer. The method employed by the intuitionists is a construction process—a building up of mathematical principles relying on the faculty of the intuition for their origin; thus their contention that logic comes from mathematics as contrasted to the belief of the logistic school that mathematics comes from logic. The principal difference between the formalists and intuitionists is that the Aristotelian logic used by the former was devised for finite sets of numbers and therefore is usable only when applied to the finite. Consequently, intuitionists object that the law of the "excluded middle," which states that a thing must have a certain property or not have it, does not apply to infinite sets. This objection does seem feasible, because the definition of an infinite set states that a part of an infinite set may contain precisely as many things as the whole.

All three of the preceding schools, however, have one common end—to put the foundations of mathematics on a sound, firm basis. In this they begin to fulfill the need for a return to first principles as voiced by Poincare and stated earlier in this paper. Today's foremost French philosopher, Jacques Maritain, has worked along this same line and has succeeded in giving a rational basis to the positive sciences. As one of the leaders of the Neo-Scholastic movement "to keep each branch of knowledge in its proper place," he has made every effort to show the rightful status of mathematics in comparison with the other fields of knowledge. In his *Degrees of Knowledge*, Maritain places mathematics subordinate only to metaphysics. He has stated that "the

enormous progress made by modern mathematics has rendered more indispensable than ever before the philosophical study of first principles of the mathematical sciences which alone can provide a rational account of the true nature of mathematical abstraction and the mental objects which it considers."

It is with this in mind that I make my plea—for a return to pure mathematics and the philosophy based on first principles which is the only logical result. Present educational tendencies, emphasizing specialized courses and neglecting theory, are fostering an unhealthy generation of mathematical robots instead of mathematical creators. The value of such courses is uncertain and highly questionable, for it cannot be denied that methods constantly differ. The isolationism of which I speak is exemplified perfectly by the type of education which produces technicians who know nothing of the essence of mathematics or its relationship to other allied speculative sciences. Therefore, to educate students with no other end than that they be good calculators or technical wizards is not sufficient.

Pure mathematics, however, necessarily leads the student to the realization of mathematics' true place in the field of knowledge. That is, it must not be lowered to the rank of a merely useful science and again it cannot be elevated to the position of a final explanation of the universe. The only remaining alternative is that mathematics be recognized in its true light—as a science superior to the empirical sciences but dependent upon the first principles of metaphysics.

This then would be the result of my policy of non-isolationism—the educating of students who, through pure mathematics, arrive at the conclusion that mathematics is contingent upon the metaphysical first principles. Instead of isolating mathematics, such a conclusion equips students with the tools necessary to build a solid, firm foundation in mathematics.

BIBLIOGRAPHY

E. T. Bell, *Development of Mathematics*. New York, McGraw-Hill Book Company, 1940.

E. T. Bell, *Men of Mathematics*. New York, Simon and Schuster, 1937.

Book Review, "Science and Wisdom," *Catholic World*, Vol. 152, pp. 244-245 (November, 1940).

E. H. Larguier, "The Schools of Thought in Modern Mathematics," *Thought*, Vol. 13, pp. 225-240 (June, 1937).

Jacques Maritain, *Introduction to Philosophy*. New York, Longmans, Green and Company, 1930.

Jacques Maritain, *The Degrees of Knowledge*. London, the Centenary Press, 1937.

F. J. Sheen, *Philosophy of Science*. Milwaukee, The Bruce Publishing Company, 1934.

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In the sphere of mathematics we are among processes which seem to some the most inhuman of all human activities and the most remote from poetry. Yet it is just here that the artist has the fullest scope for his imagination. We are in the imaginative sphere of art, and the mathematician is engaged in a work of creation which resembles music in its orderliness. It is not surprising that the greatest mathematicians have again and again appealed to the arts in order to find some analogy to their own work. They have indeed found it in the most varied arts, in poetry, in painting, and in sculpture, although it would certainly seem that it is in music, the most abstract of all the arts, the art of number and time, that we find the closest analogy.

—HAVELOCK ELLIS.

COMPUTATION OF FIRING DATA FOR FIELD ARTILLERY [1]

THOMAS E. SELBY

Central Michigan College

The mathematics involved in the computation of firing data for Field Artillery is very simple. We were told when we started the study of gunnery that all that was necessary to compute firing data was a knowledge of "grocery store" arithmetic.

First of all in the study of the mathematics of Field Artillery is the understanding of the *mil* which is the unit of angular measurement used. The mil is defined as the amount of angle subtended by an arc one unit long at a distance of 1000 units from the vertex.

Since a radian is the angle subtended at the center of a circle by an arc equal in length to the radius, it will be seen that according to the second definition that 1000 mils are equal to one radian. The circumference of a circle is $2\pi r$, or 6.283 radians in 360 degrees, whence there are 6,283 mils in four right angles. This disagreement with the first definition is due to the fact that 6,283 is not a convenient number with which to work, or with which to mark a scale on angle-measuring instruments, so the number 6,400 is used instead. The discrepancy is negligible when angles of not over 300 or 400 mils are used and can be ignored in larger angles when great accuracy is not essential.

As the chord of a very small arc is practically the same length as its arc, it is customary to consider that a mil is the angle subtended by an object one unit in length at 1000 units distance. This assumption gives fairly accurate results for angles up to 400 mils.

The Field Artillery uses the formula $m = w/R$ (called the mil-relation formula), in which m is the angle in mils,

w is the width of an object, and R is the range or distance in thousands of yards. This formula if written $w = mR$ will be recognized as analogous to the formula for the length of an arc of a circle, $s = \theta r$, where s is the length of arc, θ is the central angle in radians, and r is the radius. Since m is approximately 1/1000 of a radian, we use R in thousands of yards. This makes the two formulas the same because the natural tangent for angles in radians is nearly the same as the number of radians in the angle. This is shown by the following table.

θ in radians	θ in mils (approx.)	tan θ
.1	100	.10033
.2	200	.20271
.3	300	.30934
.4	400	.42279

We assume that the object or line subtending the angle is in the position of the base of an isosceles triangle. The base angles of an isosceles triangle approach 90 degrees (1600 mils) in size if the legs are lengthened and the base remains the same. In an isosceles triangle whose legs are several times as long as the base, the base angles will be not much less than 1600 mils.

The parts of the firing commands that the observor must compute are the Y-azimuth, the range, and the angle site. These can be computed with the use of a compass, the mil-relation formula, and a good eye for estimating ranges. The following problem is a typical example. In the figure, an observor is at O, the guns are at G, and the target is at T. The ranges are estimated and the angles are measured, giving the following data:
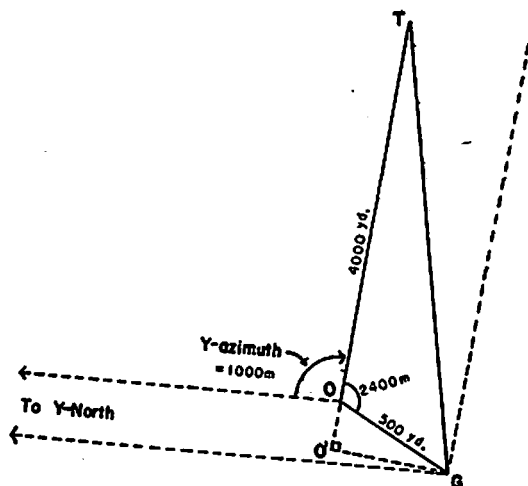
Distance $OT = 4{,}000$ yd.
Distance $OG = 500$ yd.
$\angle\ TOG = 2{,}400$ m.
Y-azimuth of T from $O = 1{,}000$ m.
Angle of elevation of T from $O = 1{,}000$ m.
Angle of depression of G from $O = 7$ m.

(The figure is not drawn to scale.)

First, angle T is found and from it the Y-azimuth for the guns is determined by use of parallel lines:

1. GO' is drawn perpendicular to OT or OT extended.
2. $GO' = GO$ sin $(\angle TOG)$ or GO sin $(\angle GOO')$
   $GO' = 500$ sin $(800\text{ m}) = 500 \times .7 = 350$ yd., using one decimal place only.
3. $OO' = 500$ cos $(800\text{ m}) = 500 \times .7 = 350$ yd.
4. $\angle T = w/R = 350/4.35 = 80$ m, to the nearest 5 m.
5. Y-azimuth for the guns is $1,000 - 80 = 920$ m.
6. Range $= 4,000 + 350 = 4,400$ yd., to nearest 100 yards.

Second, the difference of elevation of the guns and the target is computed, giving the angle of site:

1. T above O: $w = 10 \times 4.0 = 40$ yd.
2. G below O: $w = 7 \times 0.5 = 3.5$ yd.
3. T is $40 + 3.5 = 43.5$ yd. above G.
4. Angle of site is $m = w/R = 43.5/4.35 = 10$ m.

Because some of the observors did not have a knowledge of trigonometry and geometry, the following simple device was used. Sines and cosines were not mentioned. Instead, factors called "obliquity factors" were memorized making tables unnecessary. These were actually the natural sines of angles to one decimal place. Side *GO'* is found by multiplying *GO* by the obliquity factor for angle *GOO'*, and *OO'* is found by multiplying *GO* by the obliquity factor for angle *OGO'*. Angle *OGO'* is found by subtracting angle *GOO'* from 1600 mils. (Angle *OO'G* was made a right angle.) To get away from using parallel lines in computing the *Y*-azimuth, the following device was used. The observor would point one hand toward the guns and the other toward the target. Then the hand pointing toward the target was moved away from the guns. If it moved *within* the *measured Y*-azimuth, angle *T* was *subtracted*; if it moved *outside,* angle *T* was added.

Most people accustomed to five-place tables think the above computations are rather crude, but they should bear in mind that the method is designed to be used under adverse conditions where speed with some degree of accuracy is the important consideration. If five-place tables are used to solve the problem above, angle *T* is found to be 82.5 m. At a distance of 4,400 yards this difference of two and one-half mils would make a difference of about ten yards. One artillery shell (105mm.) covers an area of 15 yards in depth and 50 yards in width, making the first calculation accurate enough. Furthermore, any computation is not any more accurate than the least accurate number used, and, inasmuch as the ranges were estimated, the mil-relation formula gives very satisfactory results.

The observor sends the data he has computed back to the guns along with other commands which are determined by the nature of the target and ammunition available. This gets the first round "on the way" and it should hit in the vicinity of the target.

TOPICS FOR CHAPTER PROGRAMS—III

Previous numbers of the PENTAGON have presented bibliographies concerning the following six subjects: (1) Women as Mathematicians; (2) The Cattle Problem of Archimedes; (3) Paper Folding; (4) Mathematical Prodigies; (5) Calculating Machines; and (6) The Bee as a Mathematician. Each of these topics should provide an interesting and instructive program for a chapter meeting.

The bibliographies in this series are not intended to be exhaustive. In most cases, only those references are included which are most likely to be accessible to the student. Many references to foreign language books and journals have been omitted for this reason. The editor will appreciate suggestions for future bibliographies.

7. SOLUTIONS OF THE QUADRATIC EQUATION

H. T. R. Aude, "The Solutions of the Quadratic Equation Obtained by the Aid of Trigonometry," *National Mathematics Magazine*, Vol. 13, pp. 118-121 (December, 1938).

I. C. Barker, "A Slide Rule for Quadratic Equations," *School Science and Mathematics*, Vol. 35, pp. 811-813 (November, 1935).

T. M. Blakeslee, "Graphical Solution of Quadratic with Complex Roots," *School Science and Mathematics*, Vol. 11, p. 270 (March, 1911).

W. Chauvenet, *A Treatise on Plane and Spherical Trigonometry.* Philadelphia, Lippincott & Company, 1875.

J. W. Cirul, "A Method for Solving Quadratic Equations," *American Mathematical Monthly*, Vol. 44, pp. 462-463 (August-September, 1937).

R. C. Colwell, "The Solution of Quadratic and Cubic Equations on the Slide Rule," *Mathematics Teacher*, Vol. 19, pp. 162-165 (March, 1926).

J. J. Corliss, "Solution of the Quadratic Equation by Means of Complex Numbers," *School Science and Mathematics*, Vol. 38, pp. 256-258 (March, 1938).

A. Darnell, "A Graphical Solution of the Quadratic Equation," *School Science and Mathematics*, Vol. 11, pp. 46-47 (January, 1911).

L. E. Dickson, *First Course in the Theory of Equations.* New York, John Wiley & Sons, 1922.

H. F. Fehr, "The Quadratic Equation," *Mathematics Teacher*, Vol. 26, pp. 146-149 (March, 1933).

L. R. Ford, "An Alignment Chart for the Quadratic Equation," *American Mathematical Monthly*, Vol. 46, pp. 508-511 (October, 1939).

T. J. Higgins, "Slide Rule Solutions of Quadratic and Cubic Equations," *American Mathematical Monthly*, Vol. 44, pp. 646-647 (December, 1937).

J. Lipka, "Alignment Charts," *Mathematics Teacher*, Vol. 14, pp. 171-178 (April, 1921).

H. G. Middleton, "Solution of Quadratic Equations," *Mathematical Gazette*, Vol. 30, p. 151 (July, 1946).

A. Porges, "Again that Quadratic Equation," *School Science and Mathematics*, Vol. 44, pp. 565-568 (June, 1944).

R. C. Reese, "Quadratic Equations in Engineering Problems," *National Mathematics Magazine*, Vol. 18, pp. 99-105 (December, 1943).

E. Schuler, "Application of Professional Treatment to the Quadratic Function," *School Science and Mathematics*, Vol. 37, pp. 536-548 (May, 1937).

A. Schultze, *The Teaching of Mathematics in Secondary Schools*. New York, The Macmillan Company, 1927.

J. A. Serret, *Traité de Trigonometrie*. Paris, Gauthier-Villars, 1900.

J. B. Shaw, "Chapter on the Aesthetics of the Quadratic," *Mathematics Teacher*, Vol. 21, pp. 121-134 (March, 1928).

F. H. Steen, "A Method for the Solution of Polynomial Equations," *American Mathematical Monthly*, Vol. 44, pp. 637-644 (December, 1937).

A. Struyk, "The Solution of the Quadratic Equation," *School Science and Mathematics*, Vol. 42, pp. 882-883 (December, 1942).

G. Weinsche, "A Graphic Determination of the Complex Solutions of the Quadratic Equation $x^2 + ax + b = 0$," *School Science and Mathematics*, Vol. 33, pp. 555-556 (May, 1933).

J. S. Woodruff, "Euclidean Construction for Imaginary Roots of the Quadratic Equation," *School Science and Mathematics*, Vol. 34, pp. 950-957 (December, 1934).

G. A. Yanosik, "Graphical Solutions for Complex Roots of Quadratics, Cubics and Quartics," *National Mathematics Magazine*, Vol. 17, pp. 147-150 (January, 1943).

J. W. A. Young, *Monographs on Topics of Modern Mathematics*. New York, Longmans, Green & Co., 1927.

8.   SCALES OF NOTATION

F. E. Andrews, "An Excursion in Numbers," *Atlantic Monthly*, Vol. 64, pp. 459-466 (October, 1934).

F. E. Andrews, *New Numbers*. New York, Harcourt, Brace & Co., 1935.

A. Bakst, *Mathematics—Its Magic and Mastery*. New York, D. Van Nostrand Company, 1941. (See pp. 9-30.)

W. W. R. Ball and H. S. M. Coxeter, *Mathematical Recreations and Essays*. Eleventh Edition. London, Macmillan and Company, 1939.

W. E. Block, "The Duomal System of Numeration and Computation," *School Science and Mathematics*, Vol. 36, pp. 743-746 (October, 1936).

H. E. Buchanan and L. C. Emmons, *Brief Course in Advanced Algebra.* New York, Houghton Mifflin Company, 1937. (See pp. 169-179.)

H. C. Christofferson, "A New Number System," *School Science and Mathematics,* Vol. 24, pp. 913-916 (December, 1924).

G. Chrystal, *Algebra, Part I.* London, Adam and Charles Black, 1910.

G. H. Cooper, *Elementary Arithmetic of the Octimal Notation.* San Francisco, Whitaker and Ray, 1902.

G. H. Cooper, *Twentieth Century System of Notation.* New Westminster, B. C., 1901.

T. Dantzig, *Number the Language of Science.* New York, The Macmillan Company, 1939.

H. S. Hall and S. R. Knight, *Higher Algebra.* London, Macmillan and Company, 1936.

W. W. Johnson, "Octonary Numeration," *New York Mathematical Society Bulletin,* 1891.

M. Kraitchik, *Mathematical Recreations.* New York, W. W. Norton and Company, 1942.

Luise Lange, "On Fingerprints in Number Words," *School Science and Mathematics,* Vol. 36, pp. 13-19 (January, 1936).

H. D. Larsen, "A Note on Scales of Notation," *American Mathematical Monthly,* Vol. 51, pp. 274-275 (May, 1944).

H. D. Larsen, "Dyadic Arithmetic," *Pentagon,* Vol. 1, pp. 14-29 (Fall, 1941).

G. R. Mirick and V. Sanford, "Scales of Notation," *Mathematics Teacher,* Vol. 18, pp. 465-471 (December, 1925).

W. E. Pitcher, "Alice in Dozenland," *Mathematics Teacher,* Vol. 27, pp. 390-396 (December, 1934).

C. Smith, *A Treatise on Algebra.* London, Macmillan and Company, 1929.

A. B. Taylor, "Octonary Numeration," *American Philosophical Society,* October, 1887.

A. B. Taylor, "Weights and Measures," *Proceedings of the American Pharmaceutical Association,* 1859.

G. S. Terry, *Duodecimal Arithmetic.* London, Longmans, Green and Co., 1938.

G. S. Terry, *The Dozen System.* London, Longmans, Green and Co., 1941.

"The Duodecimal Society of America," *School Science and Mathematics,* Vol. 44, p. 694 (November, 1944).

E. M. Tingley, "Base Eight Arithmetic and Money," *School Science and Mathematics,* Vol. 40, pp. 503-508 (June, 1940).

E. M. Tingley, "Calculate by Eights, Not by Tens," *School Science and Mathematics,* Vol. 34, pp. 395-399 (April, 1934).

E. M. Tingley, "Octic Arithmetic." Philadelphia, Lefax, 1921.

G. M. Wilson, M. B. Stone, and C. D. Dalrymple, *Teaching the New Arithmetic.* New York, McGraw-Hill Book Company, 1939.

G. W. Wishard, "The Octo-Binary System," *National Mathematics Magazine,* Vol. 11, pp. 253-254 (March, 1937).

9. THE PLANIMETER

H. E. Cobb, "The Hatchet Planimeter," *School Science and Mathematics,* Vol. 15, p. 802 (December, 1915).

W. Cox, *A Manual on the Polar Planimeter.* New York, Keuffel and Esser Co., 1915.

J. Edwards, *A Treatise on the Integral Calculus, Vol. 1.* London, Macmillan and Company, 1930. (See pp. 515-523.)

W. A. Granville, *Elements of the Differential and Integral Calculus.* New York, Ginn and Company, 1911. (See pp. 446-448.)

A. W. Larson, "How a Polar Planimeter Works," *School Science and Mathematics,* Vol. 35, pp. 932-941 (December, 1935).

E. W. Ponzer, "A Homemade Planimeter for Classroom Use," *School Science and Mathematics,* Vol. 11, pp. 242-245 (March, 1911).

W. G. Raymond, *Plane Surveying.* New York, American Book Company, 1914.

J. A. Serret and G. Scheffers, *Lehrbuch der Differential und Integralrechnung.* Leipzig, Teubner, 1907. (See pp. 282-287.)

F. A. Willers, *Mathematische Instrumente.* Berlin, Walter de Gruyter & Co., 1926. (See pp. 58-85.)

Encyclopaedia Britannica, 11th ed. See "Planimeters."

The mathematics is usually considered as being the very antipodes of poesy; yet mathesis and poesy are of the closest kindred, for they are both works of imagination.

—THOMAS HILL.

THE INSTALLATION OF KANSAS DELTA CHAPTER

The thirty-second chapter of Kappa Mu Epsilon was installed at Washburn Municipal University in Topeka, Kansas, on Saturday evening, March 29, 1947. The impressive candlelight ceremony was held in the drawing room of Benton Hall. The installation was conducted by Sister Helen Sullivan, national historian of Kappa Mu Epsilon, assisted by Sister Jeanette Obrist, Mary Jane Fox, Joanne Shuey, Elizabeth Gulde, and Frances Knightley, all of Kansas Gamma Chapter. Terry McAdam, president of the Washburn mathematics club, introduced Sister Helen who explained the nature and purpose of Kappa Mu Epsilon. Following the installation and the singing of the fraternity song, the group enjoyed an informal tea.

The charter members of Kansas Delta Chapter include the following 25 faculty members and students.

FACULTY

Paul E. Eberhart	Margaret E. Martinson
Laura Z. Greene	Donal H. Webb

STUDENTS

Jean Badders	Harold McQuiston
Beverley Brown	Gerald Mowery
Lolafaye Coyne	Jack Myers
Ernest Dillman	John Nipps
Mary Fix	Thomas Pirotte
Evelyn Hazlitt	Charles Putt
Thomas Hotchkiss	William Robertson
Jean Hobble	Harold Snider
Madeleine Martinson	Wilbur Stover
Terry McAdam	Eugene Tidwell

William Willard

The following officers for 1947-1948 were installed.

President _____Thomas Hotchkiss
Vice-President _____Jean Badders
Secretary _____Evelyn Hazlitt
Treasurer _____Jean Hobble
Sponsor _____Laura Z. Greene
Corresponding Secretary ____Margaret E. Martinson

THE MATHEMATICAL SCRAPBOOK

Thought is the labour of the intellect, reverie is its pleasure.
                                            —VICTOR HUGO.

$$=\nabla=$$

How many telephone poles are necessary to reach the moon?

$$=\nabla=$$

Descartes introduced the practice of using the last letters of the alphabet for the unknowns and the first letters for the knowns.

$$=\nabla=$$

"Eventually, weather forecasting must be resolved into a series of formulae which will permit the neophyte in the science to insert proper values of the variables into a series of equations. He can then solve for x and get the forecast weather. Only when mathematics, substituted for experience, can provide a forecast will meteorology have progressed significantly as a science."

                                            —F. W. VAN STRATEN.

$$=\nabla=$$

$$370 = 3^3 + 7^3 + 0^3$$

$$=\nabla=$$

You have eight similar coins and a beam balance. At most one coin is counterfeit and hence underweight. How can you determine whether there is an underweight coin, and if so, which one, using the balance only twice?

                                            —AM. MATH. MONTHLY.

"The geometer's task is unmanageable: first, because he cannot fully demonstrate a single theorem; second, because he cannot solve all of the problems the geometrical realm poses."

—RUFUS SUTER.

$=\nabla=$

If we label the thumb and fingers in the order in which they occur on a hand as 0, 1, 2, 3, 4 to correspond to the angles 0°, 30°, 45°, 60°, and 90°, then the sine of the angle is one-half the square root of the number of the finger.

$=\nabla=$

Place twenty-four matches so as to form three rows of squares, each row having three squares. Now remove eight matches so that the remaining sixteen form two squares.

$=\nabla=$

Decode the following.

$$
\begin{array}{r}
SLAP \\
+ \ DEB \\
\hline
DUDE
\end{array}
\qquad
\begin{array}{r}
SLAP \\
- \ DEB \\
\hline
PIPS
\end{array}
$$

—AM. MATH. MONTHLY.

$=\nabla=$

Suppose you are using a toaster which toasts two slices of bread, one side at a time, when each must be turned and the other side toasted. If it takes one minute to toast one side of the bread, describe a method whereby three slices of bread can be toasted on both sides in three minutes.

$=\nabla=$

A United States Savings Bond purchased for $75 is worth $100 at the end of 10 years, the rate of interest earned

being approximately 2.9% compounded annually. Suppose one cent had been invested at this modest rate on January 1 in the year 1 A. D. What would the amount have been on January 1, 1947? Would it be about $1,000,000? Would it be sufficient to pay off the national debt of over $200 billion? Or would the amount be sufficient to build a Washington Monument of gold?

If A represents the amount and r the rate of interest, then
$$A = 0.01(1 + r)^{1946}$$
But $(1 + r)^{10} = 4/3$, so that
$$A = 0.01(4/3)^{194.6}$$
In round numbers,
$$A = \$20,560,000,000,000,000,000,000,000.$$
This huge sum is virtually incomprehensible. To assist the imagination, let us assume that one million dollars is equal to a 15.5 inch cube of standard gold (based on the Presidential proclamation of January 31, 1934). Then the volume of gold required to pay the compound amount would cover the United States to a depth of 526 feet! The Washington Monument would rise about 20 feet above this golden carpet.

If the fund earned 5% compounded annually, the amount produced by the one cent is truly fantastic. In this case,
$$A = 0.01(1 + 5\%)^{1946} = \$1.80 \times 10^{39}.$$
Converted into gold, this amount would be sufficient to form over 8,000,000 strings of golden beads, each bead the size of the earth, and each string reaching from the earth to the sun.

=▽=

Let $f(x) = x^2 - 2ax + a^2 + b^2 = 0$ have two complex roots $a \pm bi$. Then a is the abscissa of the vertex of the parabola $y = f(x)$, and b is the square root of the ordinate of the vertex.

=▽=

$\pi = 355/113$, approximately.

Is it possible for two men, wholly unrelated to each other, to have the same sister?

$$=\nabla=$$

11	22	33	99
× 11	× 22	× 33	× 99
1	2	3	9
111	222	333 etc.	999
121	242	363	1089
× 1	× 2	× 3	× 9
121	484	1089	9801

$$=\nabla=$$

"Galileo was born in 1564, the year in which Michelangelo died. Galileo died in 1642, the year in which Newton was born. Thus the history of 250 years of human greatness can be written with the use of only three words—Michelangelo, Galileo, Newton."

—CHARLES S. SLICHTER.

$$=\nabla=$$

To square a number in the fifties, add the unit figure to 25 and annex the square of the unit figure. If the square of the unit figure is less than 10, insert a cipher before the square. Thus, $(57)^2 = 3249$ and $(52)^2 = 2704$.

$$=\nabla=$$

In walking along a street on which electric cars are running at equal intervals from both ends, I observe that I am overtaken by a car every 12 minutes, and that I meet one every 4 minutes. What are the relative rates of myself and the cars, and at what intervals of time do the cars start?

—SCHOOL SCIENCE & MATH.

The date of Easter in any year in this century may be found as follows. Let $Y =$ the year, and determine in turn

$$Y/19 = a + A/19$$
$$Y/4 = b + B/4$$
$$Y/7 = c + C/7$$
$$(19A + 24)/30 = d + D/30$$
$$(2B + 4C + 6D + 5)/7 = e + E/7$$

Then the date of Easter is March 22 $+ D + E$.

$$=\nabla=$$

The speed of a chemical reaction diminishes with the lowering of the temperature. For a drop of 10° C. the speed is approximately halved. In other words, if a substance burns completely in 1 second at 90°, it will burn completely in 2 seconds at 80°, etc. If a quantity of wood burns completely in 1 second at 600° C., show that it will take about 30 billion years at 0° C.

Galileo, who is probably the inventor of the cycloid, found its area by cutting the curve and its generating circle out of cardboard, and then weighing each piece. He found that the cycloid weighed nearly three times as much as the generating circle. Experimentally, Galileo was not able to show that one area was exactly three times the other; in fact, he believed that the two areas were incommensurable.

$$=\nabla=$$

The Nasik Square is the most perfect form of magic square known. There are at least 30 ways of obtaining the magic sum 34. How many can you find?

1	14	7	12
15	4	9	6
10	5	16	3
8	11	2	13

$$=\triangledown=$$

At fifteen, Mondeaux was presented to the Academy of Science and, to the great astonishment of the members of this learned body, solved almost instantly problems such as the following.

Find a number such that its cube added to 84 will equal the product of that number by 37.
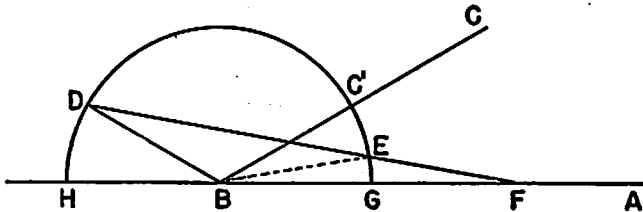
Find two squares whose difference is 133.

—LITERARY DIGEST.

$$=\triangledown=$$

There is a train of flat cars one mile long traveling at a rate of one mile a minute. A man stands on the rear end holding a rifle with a muzzle velocity of one mile a minute. He shoots at a man standing on the front end. Will the bullet reach its target?

$$=\triangledown=$$

The following diagram presents a method for trisecting any acute angle.

Given ∠ *ABC*. Produce *AB*. Describe any size arc with *B* as center, cutting *AB* at *G* and *H*, and *BC* at *C'*. Take *DH* = *C'G*, and draw *DB*. Mark on a straight edge a distance equal to *DB*. Maintaining the straight edge on *D*, move the remote mark along *GA* until the other mark cuts the arc, so that *EF* = *DB*. Draw *BE*. Then ∠ *EBG* = ¹/₃ ∠ *ABC*.

Let $a + b = 2c$. Then

$$(a + b)(a - b) = 2c(a - b)$$
$$a^2 - 2ac = b^2 - 2bc$$
$$(a - c)^2 = (b - c)^2$$
$$a - c = b - c$$
$$a = b$$

$$=\nabla=$$

In our village are seven residents, whose names are Mr. Bloodhound, Mr. Cocker, Mr. Mastiff, Mr. Peke, Mr. Pom, Mr. Pug, and Mr. St. Bernard. They severally, but not respectively, possess a bloodhound, a cocker, a mastiff, a peke, a pom, a pug, and a St. Bernard.

None of them has a breed of the same name as himself.

Three of these villagers have dogs which are considerably larger than their canine namesakes.

Only one villager has a dog of a breed of which the name begins with the initial letter of his own name.

Mr. Mastiff's dog's human namesake is married.

The St. Bernard is Mr. Pom's wife's sister's husband's dog.

The mastiff's weight is the same as his owner's fiancee.

Mr. St. Bernard's dog's human namesake is the owner of the Peke.

The cocker's owner's canine namesake is owned by the human namesake of Mr. Mastiff's dog.

Of the seven villagers, Mr. Peke and Mr. Pug are the only bachelors.

What dog belongs to whom?

$$=\nabla=$$

These problems were proposed simply for pleasure; the wise man can invent a thousand others, or he can solve the problems of others by the rules given here. As the sun eclipses the stars in brilliancy, so the man of knowledge will eclipse the fame of others in assemblies of the people if he proposes algebraic problems, and still more if he solves them.
—BRAHMAGUPTA (628 A. D.)

THE SIXTH BIENNIAL CONVENTION

The sixth biennial convention of Kappa Mu Epsilon was held at Illinois State Normal University, Normal, Illinois, on April 11 and 12, 1947. The Illinois Alpha Chapter, hosts for the occasion, earned the deep appreciation and thanks of all the delegates for the time and effort they spent to make the convention an outstanding event in the history of the fraternity.

Delegates to the convention began to arrive on Thursday, April 10. For their entertainment, an informal get-together was arranged in the evening at Fell Hall where members of the Illinois Alpha Chapter were on hand to welcome the visiting delegates.

The National Council of Kappa Mu Epsilon met on Thursday evening at the Rogers Hotel in Bloomington. Guests at the Council dinner included Professors Atkin, Bey, Flagg, Larsen, McCormick, Mills, and Ullsvik of the Illinois Alpha Chapter, Professors Larsen and Van Engen of the Committee on Fraternal Affairs, and Past-President Newsom. Following the dinner, the National Council met in business session to discuss problems of the fraternity. Reports were submitted by the officers, petitions for chapters were discussed, and several recommendations submitted by the Committee on Fraternal Activities were considered and approved.

Registration took place at 9:00 A. M. on Friday in the Capen Auditorium of the Industrial Arts Building. The registration committee enrolled 169 delegates as follows:

Alabama Alpha, Athens	6
Alabama Beta, Florence	7
Alabama Gamma, Montevallo	2

Illinois Alpha, Normal	52
Illinois Beta, Charleston	6
Illinois Gamma, Chicago	6
Illinois Delta, Joliet	8
Iowa Alpha, Cedar Falls	5
Kansas Alpha, Pittsburg	2
Kansas Beta, Emporia	6
Kansas Gamma, Atchison	8
Kansas Delta, Topeka	6
Michigan Alpha, Albion	3
Michigan Beta, Mount Pleasant	6
Michigan Gamma, Detroit	3
Mississippi Beta, State College	1
Missouri Alpha, Springfield	5
Missouri Beta, Warrensburg	1
Nebraska Alpha, Wayne	15
New Mexico Alpha, Albuquerque	4
New York Alpha, Hempstead	3
Ohio Alpha, Bowling Green	1
Oklahoma Alpha, Tahlequah	5
Tennessee Alpha, Cookeville	2
Texas Alpha, Lubbock	2
Texas Beta, Dallas	4

President E. R. Sleight presided at the three sessions of the convention which were held in Capen Auditorium. The program follows.

FRIDAY, APRIL 11

10:00 A. M.   General Assembly.

1. Address of Welcome.
   By President R. W. Fairchild, Illinois State Normal University.
2. Response.
   By Professor H. Van Engen, Iowa Alpha.
3. Address, "The Mathematical Method."
   By Past-President C. V. Newsom, Oberlin College.

4. Reading of Stephen Leacock's, "The Human Element of Mathematics."
   By Professor Ruth Yates, Illinois State Normal University.
5. Address, "Teaching Meanings in Mathematics."
   By Professor E. H. Taylor, Illinois Beta.

12:30 P. M.   Luncheon in Fell Hall Cafeteria.
1:45 P. M.   Business Meeting.
4:30 P. M.   Campus and Community Tour.
6:30 P. M.   Banquet at the Y. W. C. A.

SATURDAY, APRIL 12

9:00 A. M.   Student Program and Business Meeting.

1. "Pattern Forms of Divisibility."
   By Robert J. Weeks, Illinois Alpha.
2. "Computation of Firing Data for Field Artillery."
   By Thomas Selby, Michigan Beta.
3. "A Plea for Non-Isolationism in Mathematics."
   By Victoria Fritton, Kansas Gamma.
4. "Mathematics in Scotland, 1717-1838."
   By Shirley Searls, Michigan Alpha.

At the business meetings, summarized reports were presented by the Treasurer, Secretary, and Editor. The Committee on Fraternal Affairs composed of Professors Larsen, Richtmeyer, and Van Engen presented a report which recommended three changes in the constitution:

1. Delete all names of former mathematicians as applied to local and national officers.
2. Amend article 1, section 1, of the By-Laws to read: "However, in any case this sum shall not be less than $25.
3. Establish a classification of honorary memberships, thereby permitting each chapter to elect not more than two honorary members each biennium.

The convention approved these recommendations in principle, referring them to a committee on constitutional revision. This committee will prepare the necessary amendments and present them to the chapters for approval.

Sister Helen Sullivan, chairman of the Committee on Resolutions, presented the following resolution to the convention:

"This, the sixth national convention of Kappa Mu Epsilon and the first since 1941, is the second of its kind, in fraternity history, to be held in the State of Illinois. We feel we are both fortunate and privileged to be gathered here at Illinois State Normal University. This state institution of higher learning is not only one of the most outstanding, but it is also the oldest in Illinois and in ten years will commemorate the first centenary of its founding. To Miss Elinor B. Flagg, our convention chairman, Kappa Mu Epsilon extends congratulations and thanks for the efficient planning and splendid organization of all convention activities. To President R. W. Fairchild and the University faculty, to Professor C. N. Mills and the staff of the mathematics department, and to the Illinois Alpha Chapter, the members of Kappa Mu Epsilon here assembled extend sincere appreciation for the spirit of cordiality, for the kind consideration and for the gracious hospitality shown to all the fraternity conventionees. Wherefore be it resolved that a rising vote of thanks be given the host institution— Illinois State Normal University."

The resolution was adopted unanimously.

Professors Tucker, Ingalls, and Mallory acted as a Nominating Committee. The following officers were nominated and elected unanimously to serve for the next biennium:

President: Henry Van Engen, Iowa Alpha.
Vice-President: H. R. Mathias, Ohio Alpha.
Historian: C. C. Richtmeyer, Michigan Beta.
Secretary: E. Marie Hove, New York Alpha.
Treasurer: L. F. Ollmann, New York Alpha.

In the contest for the purpose of choosing a new K. M. E. song, only two chapters submitted entries. A song written by Kansas Gamma was sung by Victoria Fritton of Kansas Gamma, accompanied by Marion Thomas of Illinois Alpha. A song written by Marion and Carroll Petersen of Nebraska Alpha was sung by Miss Rohr of New York Alpha and Doris Wyatt of Texas Beta, accompanied by Marion Thomas of Illinois Alpha. The songs were referred to the National Council for further study, and it was suggested that the words and music be made available to the chapters.

Five petitions for chapters which had been approved by the National Council were presented to the voting delegates for action:

> Texas State College for Women, Denton, Texas.
> Texas Christian University, Fort Worth, Texas.
> Baldwin-Wallace College, Berea, Ohio.
> William Jewell College, Liberty, Missouri.
> Mount Mary College, Milwaukee, Wisconsin.

All five petitions were approved. The installations of these chapters will increase the chapter roll to thirty-seven chapters. It was announced that several additional petitions have been received by the National Council, indicating a continued growth in the fraternity.

The banquet at the Bloomington Y. W. C. A. proved to be a high spot of the convention. The local committee must be congratulated for their fine work in making the arrangements for this splendid affair. The excellent menu consisted of "continuous functions, moment of inertia, invariant solids, theory of groups, maximum polyhedrons, combinations and permutations, constants and invariants, maximum limit, and complements." The theme of the program was Keep Mathematics Effective. Miss Violet Hochmeister, alumnus member of Illinois Alpha, presided as toastmistress. Professor Mills introduced the visiting delegations, some of whom responded with singing their state songs.

BANQUET PROGRAM

Vocal Solos _____George Schmink
                    Accompanist, Alice Mills
Welcome _____Dr. C. N. Mills
Response _____Miss E. Marie Hove
Greetings _____Dr. Mary Renich
From the Pentagon Editor _____Dr. H. D. Larsen
From the President _____Dr. E. R. Sleight

 ⁃ The delegates agreed that the 1947 convention of Kappa
Mu Epsilon was eminently successful, and certainly a good
time was enjoyed by all the delegates.

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    Given any domain of thought in which the fundamental
objective is a knowledge that transcends mere induction or
mere empiricism, it seems quite inevitable that its processes
should be made to conform closely to the pattern of a system
free of ambiguous terms, symbols, operations, deductions;
a system whose implications and assumptions are unique and
consistent; a system whose logic confounds not the necessary
with the sufficient where these are distinct; a system whose
materials are abstract elements interpretable as reality or
unreality in any forms whatsoever provided only that these
forms mirror a thought that is pure. To such a system is
universally given the name of MATHEMATICS.
                                        —S. T. SANDERS.

A MESSAGE FROM THE PAST-PRESIDENT

The student of unusual ability has always been an inspiration, as well as a challenge, to any teacher. In an article which appeared in *School and Society*, Dr. G. R. Williams of Amherst College emphasized the advantages of a plan of teaching that would challenge the superior student. In recent years this plan has taken the form of research in many of our colleges. To what extent should this spirit of research among undergraduates be encouraged? In a lecture given by Dr. Angell, the former President of Yale University, we find this statement: "Individual initiative, resourceful ingenuity, imagination, vision, must be kept at high pitch." The modern spirit of scientific research has gripped us, and I believe it has become something of a dominant note in our teaching.

It is my opinion that Kappa Mu Epsilon has much to contribute to undergraduate mathematics in our colleges and universities. That something has been done in certain chapters was evidenced by the papers presented by the students at the Normal convention. I believe that creative work should be encouraged, and the research ideal should become an ideal for each chapter. In this way we bring the student face to face with a problem, and he learns to devise methods for its solution. Perhaps this is the ultimate purpose of education, and if this is true, what better method than a plan of undergraduate research can be devised?

E. R. SLEIGHT,
Past-President.

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REPORT OF THE NATIONAL TREASURER
NOVEMBER 1943 TO APRIL 1947

Receipts

Cash received from former treasurer		$ 633.42
Receipts from chapters:		
Initiation fees	$3734.50	
Dues	629.00	
Installation of chapters	75.00	
Miscellaneous	69.22	4507.72
Miscellaneous receipts:		
Interest on U. S. bonds	122.50	
Subscriptions to Pentagon	117.32	
Commission on jewelry	122.00	
Other	6.60	368.42
TOTAL RECEIPTS		$5509.56

Expenditures

Pentagon	$1405.57	
Council meeting May, 1944	211.67	
National offices expense	608.13	
Installation of chapters	63.35	
Membership certificates	62.60	
Miscellaneous	10.20	
TOTAL EXPENDITURES		$2361.52
Cash on hand April 2, 1947		$3148.04
U. S. bonds held by Professor		
Van Engen		1775.00
BALANCE APRIL 2, 1947		$4923.04

LOYAL F. OLLMANN,
National Treasurer.

REPORT OF THE EDITOR AT THE SIXTH BIENNIAL CONVENTION, APRIL 10, 1947

An official journal of Kappa Mu Epsilon was authorized at the fifth biennial convention held at Warrensburg, Missouri, on April 18 and 19, 1941. The task of planning the journal and the formulation of its editorial policy was entrusted to Dr. C. V. Newsom, past president of Kappa Mu Epsilon. Dr. Newsom presented the first number of the Pentagon to the fraternity in the Fall of 1941. After seeing three subsequent numbers through the press, Dr. Newsom found it necessary to resign as editor because of the burden of other duties occasioned by the national emergency. At the request of the National Council of Kappa Mu Epsilon, the present editor assumed his duties in the Fall of 1943.

To date, the Pentagon has been issued nine times. The printing of volume 1, number 1, consisted of 500 copies. We shall print over 1,000 copies of the forthcoming number (Spring, 1947) which is scheduled to go to press about the first of May. Since there are only 60 subscriptions which lapse with this number (many of which we trust will be renewed), it is clear that the Fall, 1947, number will run well over 1,000 copies.

Considerable difficulty has been experienced with the addresses of subscribers due to the fact that the postage paid for mailing the Pentagon does not permit forwarding unclaimed copies. At first it was attempted to send the Pentagon to the school addresses of students. However, this was found to be impractical because of the large number of Pentagons which were returned. Too many students graduate, transfer, or change residences. At the present time the Pentagon is mailed to the permanent address of each subscriber. This has proven rather successful; only eighteen copies of the last issue were returned unclaimed. It is hoped that this practice will meet with the approval of all sub-

scribers. Of course, the editor must be notified of any change in a subscriber's permanent address.

There have been a few editorial problems in publishing the Pentagon. The emphasis on the war effort necessitated a curtailment of some of our plans. Thus, two of the war-time volumes were issued but once a year rather than semi-annually as planned. Also, several chapters became inactive or carried on their activities with a bare minimum of members. Under the circumstances, these chapters were not able to contribute much to the Pentagon. The war also retarded the growth of the subscription list. This, of course, increased the cost of the Pentagon per copy and necessitated a retrenchment in certain editorial projects.

The editor has been rather disappointed to note the relatively few papers submitted by student members. Of twenty-eight articles published in the Pentagon, only twelve have been written by students. More discouraging, these twelve articles have come chiefly from three chapters. Without question the dearth of papers from some chapters can be attributed to the war. But now it should be emphasized once again that the success of the Pentagon will depend to a great extent upon the amount of cooperation given the editors by the organized chapters and individual members of Kappa Mu Epsilon. Each chapter must recognize its obligation towards the Pentagon. There must be more and better papers submitted by students. It is my earnest wish that the Pentagon will become recognized as a medium for the publication of outstanding student papers and thereby bring honor and prestige to the entire fraternity. If each chapter will make it a point to contribute at least one student paper each year, the achievement of this goal will be assured.

The pages of the Pentagon afford an opportunity to all student members of Kappa Mu Epsilon to present the results of reading and investigation, especially along lines not likely to be included in regular class work. Such authorship presents many awards. In addition to the accumulation of information in by-paths of mathematics, the student author

cultivates independence of study, gains experience in expressing clearly the results of such study, and above all experiences the intense personal satisfaction of seeing his own creation in print. That is a thrill which every student should seek to enjoy.

In the hope that students might be stimulated to prepare more and better papers for the Pentagon, the National Council has voted to sponsor a competition among student members of Kappa Mu Epsilon. For the best paper published in the Pentagon during the next biennium, the student author will be awarded a free trip to the next convention or a cash award of $25 in lieu of the trip. The prize-winning paper will be selected by a special committee which will be announced later. I urge each chapter of Kappa Mu Epsilon to set themselves the goal of submitting at least one article in this competition.

HAROLD D. LARSEN,
Editor.

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The editor takes pleasure in announcing that he is joining the faculty at Albion College. After September 1, 1947, the address of the editorial office will be Harold D. Larsen, Albion College, Albion, Michigan.