

Pacific Journal of Mathematics

VOLUME IX

1959

PACIFIC JOURNAL OF MATHEMATICS

EDITORS

DAVID GILBARG

Stanford University
Stanford, California

R. A. BEAUMONT

University of Washington
Seattle 5, Washington

A. L. WHITEMAN

University of Southern California
Los Angeles 7, California

L. J. PAIGE

University of California
Los Angeles 24, California

ASSOCIATE EDITORS

E. F. BECKENBACH

C. E. BURGESS

E. HEWITT

A. HORN

V. GANAPATHY IYER

R. D. JAMES

M. S. KNEBELMAN

L. NACHBIN

I. NIVEN

T. G. OSTROM

H. L. ROYDEN

M. M. SCHIFFER

E. G. STRAUS

G. SZEKERES

F. WOLF

K. YOSIDA

SUPPORTING INSTITUTIONS

UNIVERSITY OF BRITISH COLUMBIA

CALIFORNIA INSTITUTE OF TECHNOLOGY

UNIVERSITY OF CALIFORNIA

MONTANA STATE UNIVERSITY

UNIVERSITY OF NEVADA

OREGON STATE COLLEGE

UNIVERSITY OF OREGON

OSAKA UNIVERSITY

UNIVERSITY OF SOUTHERN CALIFORNIA

STANFORD UNIVERSITY

UNIVERSITY OF TOKYO

UNIVERSITY OF UTAH

WASHINGTON STATE COLLEGE

UNIVERSITY OF WASHINGTON

* * *

AMERICAN MATHEMATICAL SOCIETY

CALIFORNIA RESEARCH CORPORATION

HUGHES AIRCRAFT COMPANY

SPACE TECHNOLOGY LABORATORIES

Printed in Japan by Kokusai Bunken Insatsusha
(International Academic Printing Co., Ltd.), Tokyo, Japan

CONTENTS

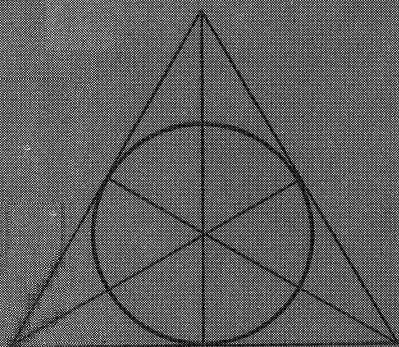
Lee W. Anderson, <i>On the breadth and co-dimension of a topological lattice.</i>	327
Frank W. Anderson and Robert L. Blair, <i>Characterizations of certain lattices of functions</i>	335
Donald C. Benson, <i>Extensions of a theorem of Loewner on integral operators</i>	365
Errett Bishop, <i>A duality theorem for an arbitrary operator</i> . .	379
Errett Bishop, <i>A minimal boundary for function algebras</i> . . .	629
Robert L. Blair, See Frank W. Anderson and Robert L. Blair.	
J. R. Blum and M. Rosenblatt, <i>On the structure of infinitely divisible distributions</i>	1
R. M. Blumenthal and R. K. Gettoor, <i>The asymptotic distribution of the eigenvalues for a class of Markov operators</i> . . .	399
D. L. Boyer and E. A. Walker, <i>Almost locally pure abelian groups</i>	409
John W. Brace, <i>The topology of almost uniform convergence</i> . .	643
F. H. Browell, <i>A note on Kato's uniqueness criterion for Schrödinger operator self-adjoint extensions.</i>	953
C. E. Burgess, <i>Chainable continua and indecomposability</i> . . .	653
R. G. Buschman, <i>Asymptotic expressions for $\sum n^a f(n) \log n$</i> . . .	9
L. Carlitz, <i>Multiplication formulas for products of Bernoulli and Euler polynomials</i>	661
E. D. Cashwell and C. J. Everett, <i>The ring of number-theoretic functions</i>	975
Paul Civin and Bertram Yood, <i>Involutions on Banach algebras</i> . .	415
Eckford Cohen, <i>A class of residue systems (mod r) and related arithmetical functions, I. A generalization of Möbius inversion</i>	13
Eckford Cohen, <i>A class of residue system (mod r) and related arithmetical functions, II. Higher dimensional analogues</i> .	667
Paul Conrad, <i>Non-abelian ordered groups</i>	25
H. O. Cordes, <i>On continuation of boundary value for partial differential operators</i>	987
Richard H. Crowell, <i>On the van Kampen theorem</i>	43
P. C. Curtis, Jr., <i>n-parameter families and best approximation</i> .	1013
L. K. Durst, <i>Exceptional real Lehmer sequences</i>	437
Eldon Dyer and Allen Shields, <i>Connectivity of topological lattices</i> .	443
C. J. Everett, See E. D. Cashwell and C. J. Everett.	
J. Feldman, <i>Correction to "Equivalence and perpendicularity of Gaussian processes"</i>	1295
Uri Fixman, <i>Problems in spectral operators</i>	1029

S. R. Foguel, <i>Boolean algebras of projections of finite multiplicity</i>	681
I. S. Gál, <i>Uniformizable spaces with a unique structure</i>	1053
John Gary, <i>Higher dimensional cyclic elements</i>	1061
R. K. Getoor, <i>Markov operators and their associated semigroups</i>	449
R. K. Getoor, See R. M. Blumenthal and R. K. Getoor.	
Irving Glicksberg, <i>Convolution semigroups of measures</i>	51
Richard R. Goldberg, <i>Averages of Fourier coefficients</i>	695
Seymour Goldberg, <i>Linear operators and their conjugates</i>	69
Seymour Goldberg, <i>Ranges and inverses of perturbed linear operators</i>	701
Richard P. Gosselin, <i>On diophantine approximation and trigonometric polynomials</i>	1071
Bernard Greenspan, <i>A bound for the orders of the components of a system of algebraic difference equations</i>	473
B. Grünbaum, <i>On some covering and intersection properties in Minkowski spaces</i>	487
Olof Hanner, <i>Mean play of sums of positional games</i>	81
Bruno Harris, <i>Derivations of Jordan algebras</i>	495
Philip Hartman, <i>On functions representable as a difference of convex functions</i>	707
Erhard Heinz, <i>On one-to-one harmonic mappings</i>	101
Gilbert Helmsberg, <i>Generating set of elements in compact groups</i>	1083
Henry Helson, <i>Conjugate series in several variables</i>	513
I. I. Hirschman, Jr., <i>A maximal problem in harmonic analysis, II</i>	525
Alfred Horn and Robert Steinberg, <i>Eigenvalues of the unitary part of a matrix</i>	541
D. R. Hughes and J. G. Thompson, <i>The H_p-problems and the structure of H_p-group</i>	1097
J. R. Isbell, <i>On finite-dimensional uniform spaces</i>	107
J. P. Jans, <i>Projective injective modules</i>	1108
M. V. Johns, Jr. and Ronald Pyke, <i>On conditional expectation and quasi-rings</i>	715
Samuel Karlin and James McGregor, <i>Coincidence properties of birth and death processes</i>	1109
Samuel Karlin and James McGregor, <i>Coincidence probabilities</i>	1141
J. L. Kelley, <i>Measures on Boolean algebras</i>	1165
John G. Kemeny, <i>Generalized random variables</i>	1179
R. J. Koch, <i>Arcs in partially ordered spaces</i>	728
Gregers L. Krabbe, <i>A space of multipliers of type $L^p(-\infty, \infty)$</i>	729
Erwin Kreyszig and John Todd, <i>On the radius of univalence of the function $\exp z^2 \int_0^z \exp(-t^2) dt$</i>	128

John Lamperti and Patrick Suppes, <i>Chains of infinite order and their application to learning theory</i>	739
Edith H. Luchins, <i>On strictly semi-simple Banach algebras</i> . . .	551
Edith H. Luchins, <i>On radicals and continuity of homomorphisms into Banach algebras</i>	755
Roger C. Lyndon, <i>An interpolation theorem in the predicate calculus</i>	129
Roger C. Lyndon, <i>Properties preserved under homomorphism</i> . .	143
Roger C. Lyndon, <i>Properties preserved in subdirect products</i> . .	155
T. M. MacRobert, <i>Multiplication formulae for the E-functions regarded as functions of their parameters</i>	759
D. G. Malm, <i>Concerning the cohomology ring of a sphere bundle</i> .	1191
Marvin Marcus, and B. N. Moyls, <i>Transformations on Tensor product spaces</i>	1215
Michael Maschler, <i>Classes of minimal and representative domains and their kernel functions</i>	763
W. S. Massey, <i>On the imbeddability of the real projective spaces in Euclidean space</i>	783
Charles A. McCarthy, <i>The nilpotent part of a spectral operator</i> .	1223
James McGregor, See Samuel Karlin and James McGregor.	
B. N. Moyls, See Marvin Marcus and B. N. Moyls.	
Thomas W. Mullikin, <i>Semi-groups of class (C_0) in L_p determined by parabolic differential equations</i>	791
W. D. Munro, <i>Some iterative methods for determining zeros of functions of a complex variable</i>	555
K. Oikawa, <i>On a criterion for the weakness of an ideal boundary component</i>	1233
Barrett O'Neill, <i>An algebraic criterion for immersion</i>	1239
S. Orey, <i>Recurrent Markov chains</i>	805
Robert Osserman, <i>A lemma on analytic curves</i>	165
E. T. Parker, <i>On quadruply transitive groups</i>	829
R. S. Phillips, <i>On a theorem due to Sz-Nagy</i>	169
R. S. Pierce, <i>A generalization of atomic Boolean algebras</i> . . .	175
M. H. Protter, <i>Vibration of a nonhomogeneous membrane</i> . . .	1249
C. R. Putnam, <i>On Toeplitz matrices, Absolute continuity, and Unitary equivalence</i>	837
Ronald Pyke, See M. V. Johns, Jr. and Ronald Pyke.	
John Rainwater, <i>Spaces whose finest uniformity is metric</i> . . .	567
William T. Reid, <i>Variational aspects of generalized convex functions</i> .	571
J. B. Roberts, <i>Analytic continuation of meromorphic functions in valued fields</i>	183
M. Rosenblatt, See J. R. Blum and M. Rosenblatt.	
Walter Rudin, <i>Idempotent measures on abelian groups</i>	195
A. Sade, <i>Isomorphism D'hypergroupoïdes isotopes</i>	583

H. H. Schaefer, <i>On nonlinear positive operators</i>	847
M. Schiffer, <i>Fredholm eigen values of multiply-connected domains</i> .	211
Robert Seall and Marion Wetzel, <i>Some connections between contin- ued fractions and convex sets</i>	861
Victor L. Shapiro, <i>Intrinsic operators on three-space</i>	1257
Allen Shields, See Eldon Dyer and Allen Shields.	
I. M. Singer, <i>The geometric interpretation of a special connection</i> .	585
V. N. Singh, <i>A note on the computation of Alder's polynomials</i> .	271
Maurice Sion, <i>On integration of 1-forms</i>	277
Robert Steinberg, <i>Variation on a theme of Chevalley</i>	875
Robert Steinberg, See Alfred Horn and Robert Steinberg.	
Patrick Suppes, See John Lamperti and Patrick Suppes.	
C. A. Swanson, <i>Asymptotic perturbation series for characteristic value problems</i>	591
Olga Taussky and Hans Zassenhaus, <i>On the similarity transforma- tion between a matrix and its transpose</i>	893
Emery Thomas, <i>The suspension of the generalized Pontrjagin cohomology operations</i>	897
J. G. Thompson, See D. R. Hughes and J. G. Thompson.	
John Todd, See Erwin Kreyszig and John Todd.	
J. P. Tull, <i>Dirichlet multiplication in lattice point problems, II</i> .	609
J. L. Ullman, <i>On Tchebycheff polynomials</i>	913
Richard S. Varga, <i>p-cyclic matrices: A generalization of the Young-Frankel successive overrelaxation scheme</i>	617
Richard S. Varga, <i>Orderings of the successive overrelaxation scheme</i>	925
Orlando E. Villamayor, <i>On weak dimension of algebras</i>	941
Elbert A. Walker, <i>Subdirect sums and infinite abelian groups</i> .	287
E. A. Walker, See D. L. Boyer and E. A. Walker	
Morgan Ward, <i>Tests for primality based on Sylvesters cyclotomic numbers</i>	1269
Marion Wetzel, See Robert Seall and Marion Wetzel.	
L. E. Ward, Jr., <i>A fixed point theorem for chained spaces</i> . .	1273
Alfred B. Willcox, <i>Silov type C algebras over a connected locally compact abelian group</i>	1279
John W. Woll, Jr., <i>Homogeneous Stochastic processes</i>	293
Bertram Yood, See Paul Civin and Bertram Yood	
Hans Zassenhaus, See Olga Taussky and Hans Zassenhaus.	

Pacific Journal of Mathematics



CONTENTS

J. R. Blum and M. Rosenblatt, <i>On the structure of infinitely divisible distributions</i>	1
R. G. Buschman, <i>Asymptotic expressions for $\sum n^a f(n) \log^n n$</i>	9
Eckford Cohen, <i>A class of residue systems (mod r) and related arithmetical functions, I. A generalization of Möbius inversion</i>	13
Paul Conrad, <i>Non-abelian ordered groups</i>	25
Richard H. Crowell, <i>On the van Kampen theorem</i>	43
Irving Glicksberg, <i>Convolution semigroups of measures</i>	51
Seymour Goldberg, <i>Linear operators and their conjugates</i>	69
Olof Hanner, <i>Mean play of sums of positional games</i>	81
Erhard Heinz, <i>On one-to-one harmonic mappings</i>	101
J. R. Isbell, <i>On finite-dimensional uniform spaces</i>	107
Erwin Kreyszig and John Todd, <i>On the radius of univalence of the function $\exp z^2 \int_0^z \exp(-t^2) dt$</i>	123
Roger C. Lyndon, <i>An interpolation theorem in the predicate calculus</i>	129
———, <i>Properties preserved under homomorphism</i>	143
———, <i>Properties preserved in subdirect products</i>	155
Robert Osserman, <i>A lemma on analytic curves</i>	165
R. S. Phillips, <i>On a theorem due to Sz-Nagy</i>	169
R. S. Pierce, <i>A generalization of atomic boolean algebras</i>	175
J. B. Roberts, <i>Analytic continuation of meromorphic functions in valued fields</i>	183
Walter Rudin, <i>Idempotent measures on abelian groups</i>	195
M. Schiffer, <i>Fredholm eigen values of multiply-connected domains</i>	211
V. N. Singh, <i>A note on the computation of Alder's polynomials</i>	271
Maurice Sion, <i>On integration of 1-forms</i>	277
Elbert A. Walker, <i>Subdirect sums and infinite abelian groups</i>	287
John W. Woll, Jr., <i>Homogeneous Stochastic processes</i>	293

PACIFIC JOURNAL OF MATHEMATICS

EDITORS

DAVID GILBARG
Stanford University
Stanford, California

R. A. BEAUMONT
University of Washington
Seattle 5, Washington

A. L. WHITEMAN
University of Southern California
Los Angeles 7, California

L. J. PAIGE
University of California
Los Angeles 24, California

ASSOCIATE EDITORS

E. F. BECKENBACH	V. GANAPATHY IYER	I. NIVEN	E. G. STRAUS
C. E. BURGESS	R. D. JAMES	T. G. OSTROM	G. SZEKERES
M. HALL	M. S. KNEBELMAN	H. L. ROYDEN	F. WOLF
E. HEWITT	L. NACHBIN	M. M. SCHIFFER	K. YOSIDA

SUPPORTING INSTITUTIONS

UNIVERSITY OF BRITISH COLUMBIA
CALIFORNIA INSTITUTE OF TECHNOLOGY
UNIVERSITY OF CALIFORNIA
MONTANA STATE UNIVERSITY
UNIVERSITY OF NEVADA
OREGON STATE COLLEGE
UNIVERSITY OF OREGON
OSAKA UNIVERSITY
UNIVERSITY OF SOUTHERN CALIFORNIA

STANFORD UNIVERSITY
UNIVERSITY OF TOKYO
UNIVERSITY OF UTAH
WASHINGTON STATE COLLEGE
UNIVERSITY OF WASHINGTON

* * *

AMERICAN MATHEMATICAL SOCIETY
CALIFORNIA RESEARCH CORPORATION
HUGHES AIRCRAFT COMPANY
THE RAMO-WOOLDRIDGE CORPORATION

Mathematical papers intended for publication in the *Pacific Journal of Mathematics* should be typewritten (double spaced), and the author should keep a complete copy. Manuscripts may be sent to any one of the four editors. All other communications to the editors should be addressed to the managing editor, L. J. Paige at the University of California, Los Angeles 24, California.

50 reprints per author of each article are furnished free of charge; additional copies may be obtained at cost in multiples of 50.

The *Pacific Journal of Mathematics* is published quarterly, in March, June, September, and December. The price per volume (4 numbers) is \$12.00; single issues, \$3.50. Back numbers are available. Special price to individual faculty members of supporting institutions and to individual members of the American Mathematical Society: \$4.00 per volume; single issues, \$1.25.

Subscriptions, orders for back numbers, and changes of address should be sent to Pacific Journal of Mathematics, 2120 Oxford Street, Berkeley 4, California.

Printed at Kokusai Bunken Insatsusha (International Academic Printing Co., Ltd.), No. 6, 2-chome, Fujimi-cho, Chiyoda-ku, Tokyo, Japan.

PUBLISHED BY PACIFIC JOURNAL OF MATHEMATICS, A NON-PROFIT CORPORATION

The Supporting Institutions listed above contribute to the cost of publication of this Journal, but they are not owners or publishers and have no responsibility for its content or policies.