

# Pacific Journal of Mathematics

VOLUME XXXIX

1971

# PACIFIC JOURNAL OF MATHEMATICS

## EDITORS

H. SAMELSON  
Stanford University  
Stanford, California 94305

C. R. HOBBY  
University of Washington  
Seattle, Washington 98105

J. DUGUNDJI  
Department of Mathematics  
University of Southern California  
Los Angeles, California 90007

RICHARD ARENS  
University of California  
Los Angeles, California 90024

## ASSOCIATE EDITORS

E. F. BECKENBACH

B. H. NEUMANN

F. WOLF

K. YOSHIDA

## SUPPORTING INSTITUTIONS

UNIVERSITY OF BRITISH COLUMBIA  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
UNIVERSITY OF CALIFORNIA  
MONTANA STATE UNIVERSITY  
UNIVERSITY OF NEVADA  
NEW MEXICO STATE UNIVERSITY  
OREGON STATE UNIVERSITY  
UNIVERSITY OF OREGON  
OSAKA UNIVERSITY

UNIVERSITY OF SOUTHERN CALIFORNIA  
STANFORD UNIVERSITY  
UNIVERSITY OF TOKYO  
UNIVERSITY OF UTAH  
WASHINGTON STATE UNIVERSITY  
UNIVERSITY OF WASHINGTON  
\* \* \*  
AMERICAN MATHEMATICAL SOCIETY  
NAVAL WEAPONS CENTER

## CONTENTS

W. O. Alltop, <i>5-designs in affine spaces</i> . . . . .	547
C. A. Akemann, <i>A Gelfand representation theory for <math>C^*</math>-algebras</i> .	1
B. G. Basmaji, <i>Real-valued characters of metacyclic groups</i> . . . . .	553
M. Benda, <i>On saturated reduced products</i> . . . . .	557
S. Berman, <i>Spectral theory for a first-order symmetric system of ordinary differential operators</i> . . . . .	13
R. L. Bernhardt, <i>On splitting in hereditary torsion theories</i> . . . .	31
E. A. Bertram, <i>Permutations as products of conjugate infinite cycles</i> . . . . .	275
D. E. Blair, <i>Almost contact manifolds with Killing structure tensors</i> . . . . .	285
J. T. Borrego, H. Cohen and E. E. DeVen, <i>Uniquely representable simigroups II</i> . . . . .	573
J. L. Brenner, <i>Gershgorin theorems, regularity theorems, and bounds for determinants of partitioned matrices II, some determinantal identities</i> . . . . .	39
R. M. Brooks, <i>On representing <math>F^*</math>-algebras</i> . . . . .	51
L. G. Brown, <i>Extensions of topological groups</i> . . . . .	71
G. L. Cain, Jr. and M. Z. Nashed, <i>Fixed points and stability for a sum of two operators in locally convex spaces</i> . . . . .	581
A. B. Calica, <i>Reversible homeomorphisms of the real line</i> . . . .	79
B. D. Calvert, <i>Nonlinear equations of evolution</i> . . . . .	293
B. Cenkl and G. Sorani, <i>Cohomology groups associated with the <math>\partial\bar{\partial}</math>-operator</i> . . . . .	351
D. R. Chalice, <i>Restrictions of Banach function spaces</i> . . . . .	593
J. T. Chambers and S. Oharu, <i>Semi-groups of local Lipschitzians in a Banach space</i> . . . . .	89
T. J. Cheatham, <i>Finite dimensional torsion free rings</i> . . . . .	113
H. Cohen, See J. T. Borrego, H. Cohen and E. E. DeVen	
E. F. Cornelius, Jr., <i>A generalization of separable groups</i> . . . .	603
J. Cunningham, <i>Primes in products of rings</i> . . . . .	615
E. E. DeVen, See J. T. Borrego, H. Cohen and E. E. DeVen	
D. E. Dobbs, <i>Amitsur cohomology of algebraic number rings</i> . .	631
B. Drachman and D. Kraines, <i>A duality between transpotence elements and Massey products</i> . . . . .	119
R. Duncan, <i>Integral representation of excessive functions of a Markov process</i> . . . . .	125
C. F. Dunkl and D. E. Ramirez, <i>Fourier-stieltjes transforms and weakly almost periodic functionals for compact groups</i> . .	637
G. A. Elliott, <i>An extension of some results of Takesaki in the reduction theory of von Neumann algebras</i> . . . . .	145
H. Fakhoury, <i>Structures uniformes faibles sur une classe de</i>	

<i>cônes et d'ensembles convexes</i>	641
P. C. Fishburn and J. H. Spencer, <i>Directed graphs as unions of partial orders</i>	149
L. R. Fletcher, <i>A note on <math>C\theta\theta</math>-groups</i>	655
H. Fong and L. Sucheston, <i>On the ratio ergodic theorem for semi-groups</i>	659
J. A. Gerhard, <i>Subdirectly irreducible idempotent semigroups</i>	669
M. Golubitsky and B. Rothschild, <i>Primitive subalgebras of exceptional Lie algebras</i>	371
H. E. Gorman, <i>Zero divisors in differential rings</i>	163
T. E. Hall, <i>Orthodox semigroups</i>	677
M. Heins, <i>A note on the Löwner differential equations</i>	173
L. Herman, <i>Semi-orthogonality in Rickart rings</i>	179
M. Herzog, <i><math>C\theta\theta</math>-groups involving on Suzuki groups</i>	687
J. W. Hinrichsen, <i>Concerning web-like continua</i>	691
F. N. Huggings, <i>A generalization of a theorem of F. Riesz</i>	695
D. Jacobson and K. S. Williams, <i>On the solution of linear G. C. D. equations</i>	187
T. J. Jech, <i>Two remarks on elementary embeddings of the universe</i>	395
C. S. Johnson, Jr., <i>On certain poset and semilattice homomorphisms</i>	703
H. H. Johnson, <i>Conditions for isomorphism in partial differential equations</i>	401
M. J. Kallaher, <i>On rank 3 projective planes</i>	207
D. Kraines, See B. Drachman and D. Kraines	
A. Lambert, <i>Strictly cyclic operator algebras</i>	717
H. Lambert, <i>Planar surfaces in knot manifolds</i>	727
S. Leader, <i>Measures on semilattices</i>	407
R. A. McCoy, <i>Groups of homeomorphisms of normed linear spaces</i>	735
D. P. Minassian, <i>On solvable <math>O^*</math>-groups</i>	215
R. A. Morris, <i>On the Brauer group of <math>Z</math></i>	619
T. S. Nanjundiah, <i>Refinements of Wallis's estimate and their generalizations</i>	745
M. Z. Nashed, See G. L. Cain, Jr. and M. Z. Nashed	
R. D. Nussbaum, <i>A geometric approach to the fixed point index</i>	751
S. Oharu, See L. T. Chambers and S. Oharu	
N. Øvrelid, <i>Generators of the maximal ideals of <math>A(\bar{D})</math></i>	219
D. S. Passman, <i>Group rings satisfying a polynomial identity II</i>	425
J. D. Pillis, <i>Convexity properties of a generalized numerical range</i>	767
M. S. Putcha and J. Weissglass, <i>A semilattice decomposition into semigroups having at most one idempotent</i>	225
D. E. Ramirez, See C. F. Dunkl and D. E. Ramirez	
D. C. Ramsey, <i>Generating monomials for finite semigroups</i>	783

R. M. Raphael, <i>Rings of quotients and <math>\pi</math>-regularity</i> . . . . .	229
W. T. Reid, <i>A disconjugacy criterion for higher order Linear vector differential equations</i> . . . . .	795
R. T. Rockafellar, <i>Integrals which are convex functionals, II</i> . .	439
B. Rothschild, See M. Golubitsky and B. Rothschild	
J. A. Siddiqi, <i>Infinite matrices summing every almost periodic sequence</i> . . . . .	235
R. E. Smithson, <i>Uniform convergence for multifunctions</i> . . . .	253
G. Sorani, See B. Cenkl and G. Sorani	
J. H. Spencer, See P. C. Fishburn and J. H. Spencer	
L. Sucheston, See H. Fong and L. Sucheston	
S. Swierczkowski, <i>Cohomology of group germs and Lie algebras</i> .	471
J. G. Thompson, <i>Nonsolvable finite groups all of whose local subgroups are solvable, III</i> . . . . .	483
A. Tucker, <i>Matrix characterizations of circular-arc graphs</i> . .	535
J. Weissglass, See M. S. Putcha and J. Weissglass	
T. P. Whaley, <i>Multiplicity type and congruence relations in universal algebras</i> . . . . .	261
R. Wiegand, <i>Globalization theorems for locally finitely generated modules</i> . . . . .	269
R. Wiegand, <i>Modules over universal regular rings</i> . . . . .	807
K. S. Williams, See D. Jacobson and K. S. Williams	
K.-W. Yang, <i>Compact functors in categories of non-archimedean Banach spaces</i> . . . . .	821
ERRATA, . . . . .	827



# Pacific Journal of Mathematics

C. A. Akemann, <i>A Gelfand representation theory for <math>C^*</math>-algebras</i> . . . . .	1
S. Berman, <i>Spectral theory for a first-order symmetric system of ordinary differential operators</i> . . . . .	13
R. L. Bernhardt, <i>On splitting in hereditary torsion theories</i> . . . . .	31
J. L. Brenner, <i>Geršgorin theorems, regularity theorems, and bounds for determinants of partitioned matrices II, some determi- nantal identities</i> . . . . .	39
R. M. Brooks, <i>On representing <math>F^*</math>-algebras</i> . . . . .	51
L. G. Brown, <i>Extensions of topological groups</i> . . . . .	71
A. B. Calica, <i>Reversible homeomorphisms of the real line</i> . . . . .	79
J. T. Chambers and S. Oharu, <i>Semi-groups of local Lipschitzians in a Banach space</i> . . . . .	89
T. J. Cheatham, <i>Finite dimensional torsion free rings</i> . . . . .	113
B. Drachman and D. Kraines, <i>A duality between transpotence elements and Massey products</i> . . . . .	119
R. Duncan, <i>Integral representation of excessive functions of Markov process</i> . . . . .	125
G. A. Elliott, <i>An extension of some results of Takasaki in the reduction theory of von Neumann algebras</i> . . . . .	145
P. C. Fishburn and J. H. Spencer, <i>Directed graphs as unions of partial orders</i> . . . . .	149
H. G. Gorman, <i>Zero divisors in differential rings</i> . . . . .	163
M. Heins, <i>A note on the Löwner differential equations</i> . . . . .	173
L. Herman, <i>Semi-orthogonality in Rickart rings</i> . . . . .	179
D. Jacobson and Kenneth S. Williams, <i>On the solution of linear <math>G.C.D.</math> equations</i> . . . . .	187
M. J. Kallaher, <i>On rank 3 projective planes</i> . . . . .	207
D. P. Minnassian, <i>On solvable <math>O^*</math>-groups</i> . . . . .	215
N. Øvrelid, <i>Generators of the maximal ideals of <math>A(\bar{D})</math></i> . . . . .	219
M. S. Putcha and J. Weissglass, <i>A semilattice decomposition into semigroups having at most one idempotent</i> . . . . .	225
R. M. Raphael, <i>Rings of quotients and <math>\pi</math>-regularity</i> . . . . .	229
J. A. Siddiqi, <i>Infinite matrices summing every almost periodic sequence</i> . . . . .	235
R. E. Smithson, <i>Uniform convergence for multifunctions</i> . . . . .	253
T. P. Whaley, <i>Multiplicity type and congruence relations in universal algebras</i> . . . . .	261
R. Wiegand, <i>Globalization theorems for locally finitely generated modules</i> . . . . .	269

# PACIFIC JOURNAL OF MATHEMATICS

## EDITORS

H. SAMELSON  
Stanford University  
Stanford, California 94305

J. DUGUNDJI  
Department of Mathematics  
University of Southern California  
Los Angeles, California 90007

C. R. HOBBY  
University of Washington  
Seattle, Washington 98105

RICHARD ARENS  
University of California  
Los Angeles, California 90024

## ASSOCIATE EDITORS

E. F. BECKENBACH

B. H. NEUMANN

F. WOLF

K. YOSHIDA

## SUPPORTING INSTITUTIONS

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

STANFORD UNIVERSITY  
UNIVERSITY OF TOKYO  
UNIVERSITY OF UTAH  
WASHINGTON STATE UNIVERSITY  
UNIVERSITY OF WASHINGTON  
\* \* \*  
AMERICAN MATHEMATICAL SOCIETY  
CHEVRON RESEARCH CORPORATION  
NAVAL WEAPONS CENTER

---

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.

---

Mathematical papers intended for publication in the *Pacific Journal of Mathematics* should be in typed form or offset-reproduced, (not dittoed), double spaced with large margins. Underline Greek letters in red, German in green, and script in blue. The first paragraph or two must be capable of being used separately as a synopsis of the entire paper. The editorial "we" must not be used in the synopsis, and items of the bibliography should not be cited there unless absolutely necessary, in which case they must be identified by author and Journal, rather than by item number. Manuscripts, in duplicate if possible, may be sent to any one of the four editors. Please classify according to the scheme of Math. Rev. Index to Vol. 39. All other communications to the editors should be addressed to the managing editor, Richard Arens, University of California, Los Angeles, California, 90024.

---

50 reprints are provided free for each article; additional copies may be obtained at cost in multiples of 50.

---

The *Pacific Journal of Mathematics* is published monthly. Effective with Volume 16 the price per volume (3 numbers) is \$8.00; single issues, \$3.00. Special price for current issues to individual faculty members of supporting institutions and to individual members of the American Mathematical Society: \$4.00 per volume; single issues \$1.50. Back numbers are available.

Subscriptions, orders for back numbers, and changes of address should be sent to Pacific Journal of Mathematics, 103 Highland Boulevard, Berkeley, California, 94708.

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

Printed at Kokusai Bunkenshuppan (International Academic Printing Co., Ltd.), 7-17, Fujimi 2-chome, Chiyoda-ku, Tokyo, Japan.