PROCEEDINGS

OF THE

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

FRED G. BRAUER
GLEN E. BREDON
W. WISTAR COMFORT
JACOB FELDMAN
RICHARD R. GOLDBERG
JOSEPH J. ROTMAN
GEORGE B. SELIGMAN

WITH THE COOPERATION OF

THOMAS A. CHAPMAN
RONALD G. DOUGLAS
JAY R. GOLDMAN
JAMES D. KUELBS
BARBARA L. OSOFSKY
ROBERT I. SOARE

Coden: PAMYAR
VOLUME 39
NUMBER 2
PAGES 221—442
JULY 1973
WHOLE NO. 169

Published by the
AMERICAN MATHEMATICAL SOCIETY
PROVIDENCE, RHODE ISLAND

Proceedings of the American Mathematical Society

THIS JOURNAL is devoted entirely to research in pure and applied mathematics, and the publication of original papers of moderate length. The maximum length of an acceptable paper is about 8 printed pages. Since a page of the PROCEEDINGS contains about 400 words, a rule of thumb is that under 10 typed pages is probably within the limit, but that over 12 typed pages is probably too long.

SHORTER NOTES. Very short notes not to exceed 1 printed page of an unusual nature are also accepted, and appear under the heading SHORTER NOTES. Items deemed suitable include an elegant new proof of an important and well-known theorem, an illuminating example or counterexample, or a new viewpoint on familiar results. New results, if of a brief and striking character, might also be acceptable, though in general a paper which is merely very short will not be suitable for the SHORTER NOTES department.

PREPARATION OF THE MANUSCRIPT. Articles for insertion should be typewritten and double spaced. Ditto is not generally satisfactory, although other modes of multiple reproduction may be. The *Manual for Authors*, available from the Society, should be consulted for symbols and style conventions. Authors should take the greatest possible care in preparing the original manuscript. Hand drawn symbols are satisfactory, if clearly done; directions to the printer should be included where necessary on a separate sheet, not in the accompanying letter. Authors must keep a complete copy of their manuscript, and editors will acknowledge receipt; manuscripts can therefore be sent by ordinary mail and any other kind (registered, certified) is entirely unnecessary. Submission of two copies of the manuscript is desirable.

FORM OF MANUSCRIPT. The first page should consist of a *descriptive title*, followed by an *abstract* which summarizes the article in language suitable for workers in the general field (algebra, analysis, etc.). The *descriptive title* should be short, but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. Also avoid proper names unless mathematical usage associates them with the work. The *abstract* should be at least one complete sentence, and at most 150 words. Included with the footnotes to your paper, but placed before the first footnote, there should be first the AMS (MOS) *subject classification numbers* representing the primary and secondary subjects of the article. This may be followed by a list of *key words and phrases* describing the subject matter of the article and taken from it. The AMS (MOS) Subject Classification Scheme (1970) with instructions for its use can be found as an appendix to Mathematical Reviews, Index to Volume 39 (June 1970). See the June 1970 Notices for more details, as well as illustrative examples.

SUBMISSION OF MANUSCRIPTS, REPRINTS AND ADDRESS CHANGES. See the last page of this issue.

GALLEY PROOF. When a paper with more than one author has been accepted for publication, only one set of galley proof will be sent. Joint authors should, therefore, indicate which of them should receive galley proof in the event that the manuscript is accepted for publication.

BACKLOG: NONE. Two-thirds of the papers currently being received by the editors will be published in 8–11 months.

SUBSCRIPTION INFORMATION. Five volumes are planned for 1973; the subscription price is $100. Back number prices are as follows: Volumes 1–16, $14 per volume; Volumes 17–19, $18 per volume; Volumes 20–26, $30 per volume; Volumes 27–30, $27 per volume; Volumes 31–39, $30 per volume.

THE PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY is published monthly. Subscriptions, orders for back numbers and inquiries in regard to nondelivery of current numbers should be addressed to the American Mathematical Society, P.O. Box 6248, Providence, R.I. 02904.
Second-class postage paid at Providence, Rhode Island, and additional mailing offices.

Copyright © American Mathematical Society 1973
Printed in the United States of America

RESEARCH AND REVIEW JOURNALS PUBLISHED BY THE AMERICAN MATHEMATICAL SOCIETY

Bulletin of the American Mathematical Society

This journal is the official organ of the Society. It reports official acts of the Society and the details of its meetings. It contains some of the officially invited addresses presented before the Society, reviews of advanced mathematical books, and a department of research announcements.

The current issue of the journal lists editors to whom prospective publications should be addressed. Publication is bimonthly.

Transactions of the American Mathematical Society

This monthly journal is devoted entirely to research in pure and applied mathematics, and includes in general longer papers than those in the PROCEEDINGS.

The current issue of the journal lists editors to whom prospective publications should be addressed.

Mathematics of Computation

A journal devoted to original papers in numerical analysis, the application of numerical methods and high-speed calculator devices, the computation of mathematical tables, the theory of high-speed calculating devices and other aids to computation. In addition it publishes reviews and notes in these and related fields.

Prospective publication should be addressed to the Editor, Professor Eugene Isaacson, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012. The author may suggest the name of an editor for review of his paper.

Mathematical Reviews

This journal is devoted to abstracts and reviews of the current mathematical literature of the world. Currently publication is monthly; two volumes are published each year, each volume consisting of 6 regular issues plus an index issue. In each regular issue the abstracts and reviews are grouped under subject headings. Publication began in 1940.

Soviet Mathematics—Doklady

This bimonthly is a translation journal containing the entire pure mathematics section of the DOKLADY AKADEMII NAUK SSSR, the Reports of the Academy of Sciences of the USSR. The DOKLADY for a year contains about 500 articles, each about 4 pages long.

Mathematics of the USSR—Izvestija

This journal is a cover-to-cover translation of IZVESTIJA AKADEMII NAUK SSSR SERIJA MATEMATIČESKAJA, published bimonthly by the Academy of Sciences of the USSR. It is a journal of current research in all fields of pure mathematics. The translation is published bimonthly starting with Volume 1, Number 1, January–February 1967.

Mathematics of the USSR—Sbornik

This journal is a cover-to-cover translation of MATEMATIČESKIĬ SBORNIK (New Series), published monthly by the Moscow Mathematical Society and the Academy of Sciences of the USSR. It is a journal of current research in all fields of pure mathematics. The translation is published monthly starting with Volume 1, Number 1, January 1967.

Submission of Manuscript

Send papers directly to one of the editors listed under the subject field of the paper.

Algebra and algebraic number theory.

BARBARA L. OSOFSKY, Department of Mathematics, Rutgers University, New Brunswick, New Jersey 08903

JOSEPH J. ROTMAN, Department of Mathematics, University of Illinois, Urbana, Illinois 61801

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Modern or classical analysis and analytic number theory.

RONALD DOUGLAS, Department of Mathematics, State University of New York, Stony Brook, New York 11790

JACOB FELDMAN, Department of Mathematics, University of California, Berkeley, California 94720

RICHARD R. GOLDBERG, Department of Mathematics, University of Iowa, Iowa City, Iowa 52240

Algebraic geometry.

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Set-theoretic and general topology.

THOMAS A. CHAPMAN, Department of Mathematics, University of Kentucky, Lexington, Kentucky 40506

W. WISTAR COMFORT, Department of Mathematics, Wesleyan University, Middletown, Connecticut 06457

Algebraic topology and all other types of geometry.

GLEN E. BREDON, Department of Mathematics, Rutgers University, New Brunswick, New Jersey 08903.

Applied mathematics, differential equations, and related areas of analysis.

FRED G. BRAUER, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706

Probability, statistics, and related fields.

JAMES D. KUELBS, Department of Mathematics, 213 Van Vleck Hall, University of Wisconsin, Madison, Wisconsin 53706

Logic, set theory, and related areas.

ROBERT I. SOARE, Department of Mathematics, University of Illinois at Chicago Circle, Chicago, Illinois 60680

Combinatorics and related areas of discrete mathematics.

JAY R. GOLDMAN, School of Mathematics, University of Minnesota, Minneapolis, Minnesota 55455

All other communications should be addressed to the Managing Editor, JOSEPH J. ROTMAN, at the above address.

Reprints and Address Changes

Any inquiries concerning a paper which has been accepted for publication, including information regarding reprints or changes of address for mailing proof, should be sent directly to the Editorial Department, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02904.

Shocks violating Lax's condition are unstable. By E. D. CONWAY and J. A. SMOLLER 353
A class of univalent functions. By T. R. CAPLINGER and W. M. CAUSEY 357

D. GEOMETRY

Families of negatively curved hermitian manifolds. By MICHAEL J. COWEN 362
Criteria for unique metric lines in Banach spaces. By E. Z. ANDALAFTE and J. E. VALENTINE 367

E. LOGIC AND FOUNDATIONS

Effective matchmaking and k-chromatic graphs. By ALFRED B. MANASTER and JOSEPH G. ROSENSTEIN 371

G. TOPOLOGY

A generalization of the dog bone space to E^n. By W. T. EATON 379
Some relations between semigroups of polyhedra. By ILAN KOZMA 388
Pin and Pin′ cobordism. By V. GIAMBALVO 395
On the representation of nonseparable analytic sets. By R. W. HANSELL 402
On the boundedness and unboundedness of certain convolution operators on nilpotent Lie groups. By ROE GOODMAN 409
Regular closed maps. By R. F. DICKMAN, JR. 414
On the reduction of complex bordism to unoriented bordism. By DAVID COPELAND JOHNSON 417
A topological proof of a theorem of Kneser. By BJORN FRIBERG 421
Indecomposable continua in Stone-Čech compactifications. By DAVID P. BELLAMY and LEONARD R. RUBIN 427
Open simple maps and periodic homeomorphisms. By JOHN D. BAILDON 433
A metric characterizing Čech dimension zero. By K. A. BROUGHAN 437
Peripherally compact tree-like spaces are continuum-wise connected. By RALPH BENNETT 441

CONTENTS*

Vol. 39, No. 2 JULY 1973 Whole No. 169

Page

A. Algebra and Number Theory

Free derivation modules and a criterion for regularity. By Selmer Moen 221
A group of exponent 4 with derived length at least 4. By S. Bachmuth, H. Y. Mochizuki and K. Weston 228
Every $n \times n$ matrix Z with real spectrum satisfies $\|Z-Z^*\| \leqq \|Z+Z^*\|$ ($\log_2 n + 0.038$). By W. Kahan 235
Prime generalized alternative rings I with nontrivial idempotent. By Harry F. Smith 242
Regular P.I.-rings. By E. P. Armendariz and Joe W. Fisher 247
Lattice sums of homogeneous functions. By Robert S. Cahn 252
The ring of polynomials over a von Neumann regular ring. By P. J. McCarthy 253
A class of partially ordered linear algebras. By Ralph DeMarr 255
A two-color theorem for analytic maps in R^n. By Bryan E. Cain 261
Commutators as products of squares. By Roger C. Lyndon and Morris Newman 267
Strict radical classes of associative rings. By Patrick N. Stewart 273
Elementary proofs of two theorems on the distribution of numbers $n\theta$ (mod 1). By Adolf Miklavc 279

B. Analysis

Distortion theorems for a special class of analytic functions. By Dorothy Browne Shaffer 281
Additions and corrections to "On the ideal structure of the algebra of radial functions." By Alan L. Schwartz 288
On Hardy's inequality and Laplace transforms in weighted rearrangement invariant spaces. By Kenneth F. Andersen 295
S-algebras on sets in C^n. By Donald R Chalice 300
Carathéodory distance and convexity with respect to bounded holomorphic functions. By Su-shing Chen 305
On Borel measures and Baire's class 3. By R. Daniel Mauldin 308
An extremal problem for the geometric mean of polynomials. By E. Beller and D. J. Newman 313
An alternate characterization of continuity. By Bruce D. Smith 318
On the growth of the Taylor coefficients of automorphic forms. By Thomas A. Metzger 321
Asymptotic inversion of Laplace transforms: A class of counterexamples. By John S. Lew 329
Dirichlet problems for singular elliptic equations. By Chi Yeung Lo 337
Automorphisms of von Neumann algebras as point transformations. By Charles Radin 343
Convolutions and absolute continuity. By D. A. Lind 347
A representation formula for harmonic functions. By Chin-hung Ching and Charles K. Chui 349

* The volume indexes contain a mapping showing the correspondence between sections A–G and the AMS (MOS) subject classification numbers.

Continued on inside back cover