Information to Subscribers

The journal is published quarterly in one volume per year with issues numbered serially since Volume I, Number 1. Volumes I–XVII (1943–1963), the price is $3.00 per issue; $12.00 per volume. Back issues are available for most issues. Write for specific information.

Unpublished Mathematical Tables

The editorial office of the journal maintains a repository of Unpublished Mathematical Tables (UMT). When a table is deposited in the UMT repository a brief summary of its contents is published in the section Reviews and Descriptions of Tables and Books. Readers may request copies of the tables from the editor, which are made available at a nominal cost.

Microcard Edition

Volumes I–X (1943–1956), Nos. 1–56 are now available on Microcards and may be purchased from the Microcard Foundation, Box 2145, Madison 5, Wisconsin, at a cost of $20.00 for the complete set. Succeeding volumes are available on request.

Information to Contributors

All contributions intended for publication in Mathematics of Computation and all books for review should be addressed to H. Polachek, Technical Director, Applied Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C. The author may suggest an appropriate editor for his paper. Manuscripts should be typewritten double-spaced in the format used by the journal. For journal abbreviations, see Mathematical Reviews, v. 25, Index for January–June 1963. Authors should submit the original and one copy, and should retain one copy.

Subscriptions, address changes, business communications and payments should be sent to:

AMERICAN MATHEMATICAL SOCIETY
180 Hope Street
Providence, Rhode Island 02906
Published Quarterly for the
NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL
by the
AMERICAN MATHEMATICAL SOCIETY
Providence, Rhode Island
Copyright © 1964, American Mathematical Society
Printed in the United States of America
Second-class postage paid at Providence, Rhode Island and at additional mailing offices.
Privileges of Membership in the

AMERICAN
MATHEMATICAL
SOCIETY

Free Subscriptions to:

NOTICES OF THE AMERICAN MATHEMATICAL SOCIETY, published 7 times a year, includes programs of the meetings of the Society, along with news items, announcements, personal items, and abstracts of papers presented at meetings.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY, publishes research announcements of timely interest, texts of invited addresses and book reviews; issued bimonthly.

PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY, publishes original research results; issued bimonthly.

Reduced rates for members to:

TRANSACTIONS OF THE AMERICAN MATHEMATICAL SOCIETY, devoted to the publication of research in pure and applied mathematics.
(List price, $32.00) $16.00 per year

MATHEMATICAL REVIEWS, devoted to abstracts and reviews of the current mathematical literature of the world.
(List price, $100.00) $32.00 per year

ALL BOOKS PUBLISHED BY THE SOCIETY available at 25% discount

NINE JOURNALS published by other institutions 20%-45% discount

Dues: $14.00 per year
For full information write to:

THE

AMERICAN
MATHEMATICAL
SOCIETY

190 Hope Street, Providence, Rhode Island
TRANSLATIONS OF MATHEMATICAL MONOGRAPHS

A new series of translations by the American Mathematical Society, translated chiefly from the Russian, of advanced mathematical research and exposition.

Vol. 1. MATHEMATICS: ITS CONTENT, METHODS AND MEANING. This three-volume survey of mathematics by eighteen eminent Russian mathematicians, under the editorship of A. D. Aleksandrov, A. N. Kolmogorov and M. A. Lavrent’ev, is being published in six parts as follows:

| Part 1: | A general view of mathematics, A. D. Aleksandrov; Analysis, M. A. Lavrent’ev and S. M. Nikol’skii | Theory of probability, A. N. Kolmogorov; Approximation of functions, S. M. Nikol’skii; Approximation methods and numerical techniques, V. I. Krylov; Electronic digital computers, S. A. Lebedev and L. V. Kantorovič |
| Part 3: | Partial differential equations, S. L. Sobolev and O. A. Ladyženskaja; Curves and surfaces, A. D. Aleksandrov; Calculus of variations, V. I. Krylov; Functions of a complex variable, M. V. Keldyš | Part 6: Topology, P. S. Aleksandrov; Functional analysis, I. M. Gel’fand; Groups and other algebraic systems, A. I. Mal’cev |
| Part 4: | Prime numbers, K. K. Mardžanišvili and A. G. Postnikov; | |

Vol. 2. Some questions in the theory of moments, N. I. Ahiezer and M. G. Krein $6.10$

Vol. 3. Semigroups, E. S. Ljapin $21.70$

Vol. 4. The dispersion method in binary additive problems, Ju. V. Linnik $12.30$

Vol. 5. Distribution of zeros of entire functions, B. Ja. Levin $23.10$

Vol. 6. Harmonic analysis of functions of several complex variables in the classical domains, L. K. Hua in preparation

Vol. 7. Applications of functional analysis in mathematical physics, S. L. Sobolev $8.70$

Vol. 8. Theory of functions of several complex variables, B. A. Fuks $13.00$

Vol. 9. Soluble and nilpotent linear groups, D. Suprunenko $4.90$

Vol. 10. The theory of irrationalities of the third degree, B. N. Delone and D. K. Faddeev in preparation


25% discount to members
Orders for single copies and standing orders for this Series should be sent to the

AMERICAN MATHEMATICAL SOCIETY
190 Hope Street, Providence 6, Rhode Island
CLASSIFICATION OF REVIEWS

A. Arithmetical Tables, Mathematical Constants
B. Powers
C. Logarithms
D. Circular Functions
E. Hyperbolic and Exponential Functions
F. Theory of Numbers
G. Higher Algebra
H. Numerical Solution of Equations
I. Finite Differences, Interpolation
J. Summation of Series
K. Statistics
L. Higher Mathematical Functions
M. Integrals
N. Interest and Investment
O. Actuarial Science
P. Engineering
Q. Astronomy
R. Geodesy
S. Physics, Geophysics, Crystallography
T. Chemistry
U. Navigation
V. Aerodynamics, Hydrodynamics, Ballistics
W. Economics and Social Sciences
X. Numerical Analysis and Applied Mathematics
Z. Calculating Machines and Mechanical Computation
## TABLE OF CONTENTS

**January 1964**

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Certain Finite Difference Schemes for Hyperbolic Systems</td>
<td>John Gary</td>
<td>1</td>
</tr>
<tr>
<td>Bounds on the Truncation Error by Finite Differences for the Goursat Problem</td>
<td>A. K. Aziz &amp; B. E. Hubbard</td>
<td>19</td>
</tr>
<tr>
<td>On the Round-Off Error in the Method of Successive Over-Relaxation</td>
<td>M. Stuart Lynn</td>
<td>36</td>
</tr>
<tr>
<td>Implicit Runge-Kutta Processes</td>
<td>J. C. Butcher</td>
<td>50</td>
</tr>
<tr>
<td>Error Analysis of Miller's Recurrence Algorithm</td>
<td>F. W. J. Olver</td>
<td>65</td>
</tr>
<tr>
<td>The Second-Order Term in the Asymptotic Expansion of $B(x)$</td>
<td>Daniel Shanks</td>
<td>75</td>
</tr>
<tr>
<td>On the Factors of Certain Mersenne Numbers, II</td>
<td>John Brillhart</td>
<td>87</td>
</tr>
<tr>
<td>Three New Mersenne Primes and a Statistical Theory</td>
<td>Donald B. Gillies</td>
<td>93</td>
</tr>
<tr>
<td>Asymptotic Computation of the Repeated Integrals of the Error Function Complement</td>
<td>W. R. Wilcox</td>
<td>98</td>
</tr>
<tr>
<td>An Approximation to the Integral of the Circular Gaussian Distribution over an Offset Ellipse</td>
<td>J. H. Cadwell</td>
<td>106</td>
</tr>
</tbody>
</table>

### Technical Notes and Short Papers

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Finite-Difference Exponential Approximation Method</td>
<td>J. W. Layman</td>
<td>113</td>
</tr>
<tr>
<td>A New Algorithm for Diagonalizing a Real Symmetric Matrix</td>
<td>C. Donald La Budde</td>
<td>118</td>
</tr>
<tr>
<td>The Calculation of Certain Bessel Functions</td>
<td>D. B. Hunter</td>
<td>123</td>
</tr>
<tr>
<td>Tables of Zeros of Cross Product Bessel Functions $J_p'(\xi) Y_p'(k\xi) - J_p(k\xi) Y_p'(\xi) = 0$</td>
<td>H. Bauer</td>
<td>128</td>
</tr>
<tr>
<td>On Convergence Criteria for the Method of Successive Over-Relaxation</td>
<td>C. G. Broyden</td>
<td>136</td>
</tr>
<tr>
<td>On Inverses of Finite Segments of the Generalized Hilbert Matrix</td>
<td>Jean L. Lavoie</td>
<td>141</td>
</tr>
<tr>
<td>The Ideal Waring Theorem for Exponents 401–200,000</td>
<td>Rosemarie M. Stemmler</td>
<td>144</td>
</tr>
<tr>
<td>Fermat Numbers and Mersenne Numbers</td>
<td>J. L. Selfridge &amp; Alexander Hurwitz</td>
<td>146</td>
</tr>
<tr>
<td>Lucas’ Test for Mersenne Numbers, 6,000 &lt; p &lt; 7,000</td>
<td>Sidney Kravitz &amp; Murray Berg</td>
<td>148</td>
</tr>
<tr>
<td>Note on the Congruence $a^{p-1} \equiv 1 \pmod{p^2}$</td>
<td>Hans Riesel</td>
<td>149</td>
</tr>
</tbody>
</table>

### Reviews and Descriptions of Tables and Books

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
</table>

### Table Errata

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
</table>

### Note

*Published Quarterly for the National Academy of Sciences—National Research Council*  
*By the*  
*American Mathematical Society*