CONTENTS

HISTORY OF MATHEMATICS

History of Mathematics - Volume 1
No. of Pages: 396
ISBN: 978-1-84826-221-8 (eBook)
ISBN: 978-1-84826-671-1 (Print Volume)

For more information of e-book and Print Volume(s) order, please click here

Or contact: eolssunesco@gmail.com
CONTENTS

Mathematics In Egypt And Mesopotamia 1
Annette Imhausen, Historisches Seminar: Wissenschaftsgeschichte, Goethe University Frankfurt, 60629 Frankfurt am Main, Germany

1. The beginnings: invention of script, numbers, and metrological systems
   1.1. Egypt
   1.2. Mesopotamia
2. Mathematical Texts: education and mathematical practices
   2.1. Egypt
   2.2 Mesopotamia
3. Beyond the school: mathematics in daily life, literature and art
   3.1. Egypt
   3.2. Mesopotamia
4. Egyptian and Mesopotamian mathematics in the Graeco-Roman periods
5. Summary: Egypt vs. Mesopotamia

History of Trigonometry to 1550 39
Glen Van Brummelen, Quest University, Canada

1. Precursors
2. Alexandrian Greece
3. India
4. Islam
5. The West to 1550

Mathematics in Japan 74
A. Horiuchi, Department of East Asian Languages and Civilizations, Université Paris Diderot, France

1. Introduction
2. The beginnings (seventh to sixteenth century)
3. Textbooks of Commercial arithmetic
4. The construction of a learned tradition
   4.1. Seki Takakazu
   4.2. Takebe Katahiro
5. Wasan status : between art and science
6. Conclusion

The Mathematization Of The Physical Sciences - Differential equations of nature 82
Jesper Lutzen, Department of Mathematical Sciences, University of Copenhagen, Denmark

1. Everything is number
2. Ancient Astronomy
3. Optics and statics
4. The middle ages and the renaissance
5. Mechanics of motion
6. Newtonian mechanics
7. Early differential equations
8. The Brachistochrone
9. Early Methods of Solution- Linear Differential Equations
10. Newton’s Second Law as a Differential Equation- The Method of Perturbations
11. The Vibrating String- Partial Differential Equations
12. The Vibrating String-Trigonometric Series
13. Potential Theory- Laplace’s equation
14. The Parsimonious Universe- Calculus of Variations
15. The Hamilton Formalism
16. Electrostatics- Poisson’s equation
17. Fourier on Heat Conduction and Fourier Series
18. Orthogonal Functions and Curvilinear Coordinates
19. Sturm-Liouville Theory- The Qualitative Theory
20. Continuum Mechanics- Elasticity
21. Hydrodynamics- The Navier-Stokes Equation
22. Electromagnetism- Maxwell’s Equations
23. Relativity
24. Quantum Mechanics- The Schrodinger Equation
25. Distributions- Generalized Solutions of Differential Equations
26. Concluding Remarks

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Short History of Dynamical Systems Theory: 1885-2007</td>
<td>115</td>
</tr>
<tr>
<td>Philip Holmes, Princeton University, Princeton, NJ 08544, U.S.A.</td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td></td>
</tr>
<tr>
<td>2. The qualitative theory of dynamical systems</td>
<td></td>
</tr>
<tr>
<td>2.1. Early History: Homoclinic Points and Global Behavior</td>
<td></td>
</tr>
<tr>
<td>2.1.1. Poincaré and Birkhoff</td>
<td></td>
</tr>
<tr>
<td>2.1.2. Andronov and Kolmogorov</td>
<td></td>
</tr>
<tr>
<td>2.1.3. Smale’s Topological Viewpoint</td>
<td></td>
</tr>
<tr>
<td>2.1.4. Perturbations and Applications</td>
<td></td>
</tr>
<tr>
<td>2.2. The Middle Period: Center Manifolds and Local Bifurcations</td>
<td></td>
</tr>
<tr>
<td>3. Central themes</td>
<td></td>
</tr>
<tr>
<td>3.1. Dimension Reduction</td>
<td></td>
</tr>
<tr>
<td>3.2. Judicious Linearization</td>
<td></td>
</tr>
<tr>
<td>3.3. Good Coordinates</td>
<td></td>
</tr>
<tr>
<td>3.4. Structural Stability and Generic Properties</td>
<td></td>
</tr>
<tr>
<td>3.5. Canonical Models</td>
<td></td>
</tr>
<tr>
<td>4. Some recent extensions and applications of dynamical systems</td>
<td></td>
</tr>
<tr>
<td>4.1. Infinite-dimensional Evolution Equations</td>
<td></td>
</tr>
<tr>
<td>4.2. Completely Integrable Partial Differential Equations</td>
<td></td>
</tr>
<tr>
<td>4.3. Stochastic Differential Equations</td>
<td></td>
</tr>
<tr>
<td>4.4. Numerically-assisted Proofs and Integration Algorithms</td>
<td></td>
</tr>
<tr>
<td>4.5. Low Dimensional Models of Turbulence</td>
<td></td>
</tr>
<tr>
<td>4.6. Nonlinear Elasticity</td>
<td></td>
</tr>
<tr>
<td>4.7. Nonlinear Dynamics in Neuroscience and Biology</td>
<td></td>
</tr>
<tr>
<td>5. Epilogue and further reading</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure Theories And Ergodicity Problems</td>
<td>139</td>
</tr>
<tr>
<td>Jean - Paul Pier, Luxembourg University Center, Luxembourg</td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td></td>
</tr>
<tr>
<td>2. Measure Theories and Probability</td>
<td></td>
</tr>
<tr>
<td>3. Invariant Measures</td>
<td></td>
</tr>
<tr>
<td>4. Ergodicity and Dynamical Systems</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Number Concept and Number Systems</td>
<td>156</td>
</tr>
<tr>
<td>John Stillwell, Department of Mathematics, University of San Francisco, U.S.A., School of Mathematical Sciences, Monash University Australia</td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td></td>
</tr>
</tbody>
</table>
2. Arithmetic
3. Length and Area
4. Algebra and Geometry
5. Real Numbers
6. Imaginary numbers
7. Geometry of Complex Numbers
8. Algebra of complex numbers
9. Quaternions
10. Geometry of Quaternions
11. Octonions
12. Incidence Geometry

**Operations Research and Mathematical Programming: From War to Academia – A Joint Venture**

Tinne Hoff-Kjeldsen, IMFUFA, Department of Science, Systems, and Models, Roskilde University, Denmark.

1. Introduction
2. Precursor of OR: Taylorism
3. The beginning of OR in Britain: The use of radar in anti-aircraft warfare
4. OR’s move to the US military: The mobilisation of civilian scientists
5. ASWORG: Philip Morse’s OR group
6. The Applied Mathematics Panel: OR training courses during Word War II
7. Game theory: The significance of John von Neumann
8. The origin of linear programming: Logistic planning in the Army Air Force
9. Mathematical programming in academia: ONR project and game theory
10. Operations research in academia: Societies, journals, and conferences
11. Classical OR problems
12. Operations research and linear programming outside academia: some examples
13. The role of mathematical programming and game theory in OR: Disputes
14. Conclusion

**Elementary mathematics from an advanced standpoint**

John Stillwell, Department of Mathematics, University of San Francisco, U.S.A. School of Mathematical Sciences, Monash University, Australia.

1. Introduction: Klein's view of elementary mathematics
2. Arithmetic
3. Computation
4. Algebra
5. Geometry
6. Calculus
7. Computers and their influence

**The History and Concept of Mathematical Proof**

Steven G. Krantz, American Institute of Mathematics, Palo Alto, California 94306 U.S.A.

1. Introduction
2. The Concept of Proof
3. What Does a Proof Consist Of?
4. The Purpose of Proof
5. The History of Mathematical Proof
   5.1. Pythagoras
   5.2. Eudoxus and the Concept of Theorem
   5.3. Euclid the Geometer
6. The Middle Ages
7. The Golden Age of the Nineteenth Century
8. Hilbert and the Twentieth Century
   8.1. L. E. J. Brouwer and Proof by Contradiction
   8.2. Errett Bishop and Constructive Analysis
   8.3. Nicolas Bourbaki
9. Computer-Generated Proofs
   9.1. The Difference between Mathematics and Computer Science
10. Closing Thoughts
   10.1. Why Proofs are Important
   10.2. What Will Be Considered a Proof in 100 Years?

Geometry In The 20th Century
M. Berger, IHES (Institut des Hautes Études Scientifiques), Bures sur Yvette, France

1. Introduction
   1.1. About History of Mathematics
   1.2. The Quite Universal Domination of Geometry in the 20th Century Mathematics
2. The Incredible Successive Enlargements of the Notions of Space and of Point
   2.1. Introduction
   2.2. Euclidean, Projective and Complex plane and Space Geometries
   2.3. A Dramatic Flow, the Increase in Dimension: Introduce Geometrical Objects of Dimension 4, or more: any Integer n, and even more: Introducing Infinite Dimensional-Spaces
   2.4. The Beginning of Non-commutativity in Geometry: Quaternions, more and more Projective Spaces
   2.5. An Incredible Story- Riemann's Prophecy: Manifolds then Riemannian Manifolds
   2.6. Variations on the Theme of \( \text{RM} \): Sub-Riemannian Manifolds, Lorentzian Manifolds
   2.7. Symplectic and Contact Manifolds
   2.8. Metric Spaces, Length Spaces, Spaces with Bounded Curvature, mm-spaces
   2.9. Spaces where their points have Things Seating above Each One: Fibered Spaces, Bundles
   2.10. Spaces and Points in Algebraic Geometry
   2.11. Maps between Spaces, Categories
   2.12. Spaces of Spaces
   2.13. Points in Mathematical Physics: Observables
3. Studying Subspaces: Classification, Measuring them, Optimality
   3.1. Notions of Subspaces
   3.2. Various Notions of Dimension, Fractals
   3.3. Classification Problems (Curves, Surfaces, Compact Manifolds, Submanifolds, etc.)
   3.4. Measuring Subspaces, Minimal Objects, Isoperimetric Inequalities, Geometric Measure Theory (GMT)
4. Some Geometric Spaces which are Surprising-Extremely Rich Crossroads
   4.1. The Trinity of Signs and the Conic Sections Trinity: Elliptic, Parabolic and Hyperbolic Objects
   4.2. Projective Spaces and Projective Geometry
   4.3. Arnold's Trinity: \( R, C, H \)
   4.4. Kähler Manifolds
   4.5. Tori
   4.6. Riemann Surfaces
   4.7. Symmetric Spaces
   4.8. Negative Curvature Spaces
   4.9. Classical Groups
   4.10. Spinors
   4.11. Polygons, Polyhedrons and Polytopes
   4.12. Knots
   4.13. Penrose Tilings
   4.14. Last but not Least: the Atiyah-Singer Index theorem
5. Groups and Geometry: A Journey There and Back
   5.1. Klein’s Celebrated Erlangen Program
   5.2. Lie Groups, Homogenous Spaces
   5.3. Gromov’s Geometric Work on Groups
5. Some Concepts and Tools Useful in Many Places
   6.1. Duality
   6.2. Symmetries
   6.3. Taming the Infinite: Projective Spaces, Compactifications, Infinite Dimension
   6.4. Invariants (Local and Global) and the Haunting of Classification
   6.5. Differential Calculus on Manifolds
   6.6. Connections (local), Parallel Transport, Yang-Mills Fields
   6.7. Various Notions of Curvatures, and from Local to Global
   6.8. More on Local to Global
   6.9. Using Computers in Geometry
6. Convexity
   7.1. Convex Sets
   7.2. Convex Functions
   7.3. Invariants of Convex Bodies
   7.4. Slicing Convex Bodies

Bourbaki, An epiphenomenon in the History Of Mathematics

Jean-Paul Pier, Luxembourg Higher Education institution, Luxembourg

1. Introduction
2. The Origins
3. The Impact
4. The Elaboration of the Volumes Constituting the Treatise

Index

About EOLSS