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

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

Glen Van Brummelen, Quest University, Canada

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

Mathematics in Japan

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 Katahiro5. Wasan status : between art and science
- 6. Conclusion

The Mathematization Of The Physical Sciences - Differential equations of nature

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

1

39

74

©Encyclopedia Of Life Support Systems (EOLSS)

- 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

1.

2

24. Quantum Mechanics- The Schrodinger Equation

The qualitative theory of dynamical systems

Poincaré and Birkhoff Andronov and Kolmogorov

- 25. Distributions- Generalized Solutions of Differential Equations
- 26. Concluding Remarks

Introduction

2.1.1.

2.1.2. 2.1.3.

2.1.4.

A Short History of Dynamical Systems Theory: 1885-2007

Philip Holmes, Princeton University, Princeton, NJ 08544, U.S.A.

2.1. Early History: Homoclinic Points and Global Behavior

Smale's Topological Viewpoint

Perturbations and Applications

2.2. The Middle Period: Center Manifolds and Local Bifurcations

115

- 3. Central themes
 - 3.1. Dimension Reduction
 - 3.2. Judicious Linearization
 - 3.3. Good Coordinates
 - 3.4. Structural Stability and Generic Properties
 - 3.5. Canonical Models
- 4. Some recent extensions and applications of dynamical systems
 - 4.1. Infinite-dimensional Evolution Equations
 - 4.2. Completely Integrable Partial Differential Equations
 - 4.3. Stochastic Differential Equations
 - 4.4. Numerically-assisted Proofs and Integration Algorithms
 - 4.5. Low Dimensional Models of Turbulence
 - 4.6. Nonlinear Elasticity
 - 4.7. Nonlinear Dynamics in Neuroscience and Biology
- 5. Epilogue and further reading

Measure Theories And Ergodicity Problems

Jean - Paul Pier, Luxembourg University Center, Luxembourg

- 1. Introduction
- 2. Measure Theories and Probability
- 3. Invariant Measures
- 4. Ergodicity and Dynamical Systems

The Number Concept and Number Systems

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

1. Introduction

156

- 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.

239

207

- 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
 - 9.2. How a Computer Can Search a Set of Axioms for the Statement and Proof of a New Theorem
- 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, IHÉS (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 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
 - 2.14. Non-commutative Geometry: Spaces and Points
- 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
- 6. 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
- 7. 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	343
About EOLSS	349