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Editors

Explanation and Proof in Mathematics

Philosophical and
Educational Perspectives

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Explanation And Proof In Mathematics Philosophical And Educational Perspectives

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Explanation And Proof In Mathematics Philosophical And Educational Perspectives:

Explanation and Proof in Mathematics Gila Hanna,Hans Niels Jahnke,Helmut Pulte,2009-12-04 In the four decades since Imre Lakatos declared mathematics a quasi empirical science increasing attention has been paid to the process of proof and argumentation in the field a development paralleled by the rise of computer technology and the mounting interest in the logical underpinnings of mathematics Explanation and Proof in Mathematics assembles perspectives from mathematics education and from the philosophy and history of mathematics to strengthen mutual awareness and share recent findings and advances in their interrelated fields With examples ranging from the geometers of the 17th century and ancient Chinese algorithms to cognitive psychology and current educational practice contributors explore the role of refutation in generating proofs the varied links between experiment and deduction the use of diagrammatic thinking in addition to pure logic and the uses of proof in mathematics education including a critique of authoritative versus authoritarian teaching styles A sampling of the coverage The conjoint origins of proof and theoretical physics in ancient Greece Proof as bearers of mathematical knowledge Bridging knowing and proving in mathematical reasoning The role of mathematics in long term cognitive development of reasoning Proof as experiment in the work of Wittgenstein Relationships between mathematical proof problem solving and explanation Explanation and Proof in Mathematics is certain to attract a wide range of readers including mathematicians mathematics education professionals researchers students and philosophers and historians of mathematics

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Imre Lakatos declared mathematics a quasi empirical science increasing attention has been paid to the process of proof and argumentation in the field a development paralleled by the rise of computer technology and the mounting interest in the logical underpinnings of mathematics Explanation and Proof in Mathematics assembles perspectives from mathematics education and from the philosophy and history of mathematics to strengthen mutual awareness and share recent findings and advances in their interrelated fields With examples ranging from the geometrists of the 17th century and ancient Chinese algorithms to cognitive psychology and current educational practice contributors explore the role of refutation in generating proofs the varied links between experiment and deduction the use of diagrammatic thinking in addition to pure logic and the uses of proof in mathematics education including a critique of authoritative versus authoritarian teaching styles A sampling of the coverage The conjoint origins of proof and theoretical physics in ancient Greece Proof as bearers of mathematical knowledge Bridging knowing and proving in mathematical reasoning The role of mathematics in long term cognitive development of reasoning Proof as experiment in the work of Wittgenstein Relationships between mathematical proof problem solving and explanation Explanation and Proof in Mathematics is certain to attract a wide range of readers including mathematicians mathematics education professionals researchers students and philosophers and historians of mathematics

Proof and Proving in Mathematics Education Gila Hanna, Michael de Villiers, 2012-06-14 THIS BOOK IS AVAILABLE AS OPEN ACCESS BOOK ON SPRINGERLINK One of the most significant tasks facing mathematics educators is to understand the role of mathematical reasoning and proving in mathematics teaching so that its presence in instruction can be enhanced This challenge has been given even greater importance by the assignment to proof of a more prominent place in the mathematics curriculum at all levels Along with this renewed emphasis there has been an upsurge in research on the teaching and learning of proof at all grade levels leading to a re examination of the role of proof in the curriculum and of its relation to other forms of explanation illustration and justification This book resulting from the 19th ICMI Study brings together a variety of viewpoints on issues such as The potential role of reasoning and proof in deepening mathematical understanding in the classroom as it does in mathematical practice The developmental nature of mathematical reasoning and proof in teaching and learning from the earliest grades The development of suitable curriculum materials and teacher education programs to support the teaching of proof and proving The book considers proof and proving as complex but foundational in mathematics Through the systematic examination of recent research this volume offers new ideas aimed at enhancing the place of proof and proving in our classrooms

Advances in Mathematics Education Research on Proof and Proving Andreas J. Stylianides, Guershon Harel, 2018-01-10 This book explores new trends and developments in mathematics education research related to proof and proving the implications of these trends and developments for theory and practice and directions for future research With contributions from researchers working in twelve different countries the book brings also an international perspective to the discussion and debate of the state of the art in this important area The book is

organized around the following four themes which reflect the breadth of issues addressed in the book Theme 1 Epistemological issues related to proof and proving Theme 2 Classroom based issues related to proof and proving Theme 3 Cognitive and curricular issues related to proof and proving and Theme 4 Issues related to the use of examples in proof and proving Under each theme there are four main chapters and a concluding chapter offering a commentary on the theme overall

The Philosophy of Mathematics Education Today Paul Ernest, 2018-06-09 This book offers an up to date overview of the research on philosophy of mathematics education one of the most important and relevant areas of theory The contributions analyse question challenge and critique the claims of mathematics education practice policy theory and research offering ways forward for new and better solutions The book poses basic questions including What are our aims of teaching and learning mathematics What is mathematics anyway How is mathematics related to society in the 21st century How do students learn mathematics What have we learnt about mathematics teaching Applied philosophy can help to answer these and other fundamental questions and only through an in depth analysis can the practice of the teaching and learning of mathematics be improved The book addresses important themes such as critical mathematics education the traditional role of mathematics in schools during the current unprecedented political social and environmental crises and the way in which the teaching and learning of mathematics can better serve social justice and make the world a better place for the future

The Best Writing on Mathematics 2015 Mircea Pitici, 2016-01-12 The year s finest writing on mathematics from around the world This annual anthology brings together the year s finest mathematics writing from around the world Featuring promising new voices alongside some of the foremost names in the field The Best Writing on Mathematics 2015 makes available to a wide audience many articles not easily found anywhere else and you don t need to be a mathematician to enjoy them These writings offer surprising insights into the nature meaning and practice of mathematics today They delve into the history philosophy teaching and everyday occurrences of math and take readers behind the scenes of today s hottest mathematical debates Here David Hand explains why we should actually expect unlikely coincidences to happen Arthur Benjamin and Ethan Brown unveil techniques for improvising custom made magic number squares Dana Mackenzie describes how mathematicians are making essential contributions to the development of synthetic biology Steven Strogatz tells us why it s worth writing about math for people who are alienated from it Lisa Rougetet traces the earliest written descriptions of Nim a popular game of mathematical strategy Scott Aaronson looks at the unexpected implications of testing numbers for randomness and much much more In addition to presenting the year s most memorable writings on mathematics this must have anthology includes a bibliography of other notable writings and an introduction by the editor Mircea Pitici This book belongs on the shelf of anyone interested in where math has taken us and where it is headed Proof Technology in Mathematics Research and Teaching Gila Hanna, David A. Reid, Michael de Villiers, 2019-10-02 This book presents chapters exploring the most recent developments in the role of technology in proving The full range of topics related to this theme are

explored including computer proving digital collaboration among mathematicians mathematics teaching in schools and universities and the use of the internet as a site of proof learning Proving is sometimes thought to be the aspect of mathematical activity most resistant to the influence of technological change While computational methods are well known to have a huge importance in applied mathematics there is a perception that mathematicians seeking to derive new mathematical results are unaffected by the digital era The reality is quite different Digital technologies have transformed how mathematicians work together how proof is taught in schools and universities and even the nature of proof itself Checking billions of cases in extremely large but finite sets impossible a few decades ago has now become a standard method of proof Distributed proving by teams of mathematicians working independently on sections of a problem has become very much easier as digital communication facilitates the sharing and comparison of results Proof assistants and dynamic proof environments have influenced the verification or refutation of conjectures and ultimately how and why proof is taught in schools And techniques from computer science for checking the validity of programs are being used to verify mathematical proofs Chapters in this book include not only research reports and case studies but also theoretical essays reviews of the state of the art in selected areas and historical studies The authors are experts in the field

Developing Research in Mathematics Education Tommy Dreyfus, Michèle Artigue, Despina Potari, Susanne Prediger, Kenneth Ruthven, 2018-04-27 Developing Research in Mathematics Education is the first book in the series New Perspectives on Research in Mathematics Education to be produced in association with the prestigious European Society for Research in Mathematics Education This inaugural volume sets out broad advances in research in mathematics education which have accumulated over the last 20 years through the sustained exchange of ideas and collaboration between researchers in the field An impressive range of contributors provide specifically European and complementary global perspectives on major areas of research in the field on topics that include the content domains of arithmetic geometry algebra statistics and probability the mathematical processes of proving and modeling teaching and learning at specific age levels from early years to university teacher education teaching and classroom practices special aspects of teaching and learning mathematics such as creativity affect diversity technology and history theoretical perspectives and comparative approaches in mathematics education research This book is a fascinating compendium of state of the art knowledge for all mathematics education researchers graduate students teacher educators and curriculum developers worldwide

The Manifold Object of Language Noury Bakrim, 2022-12-05 This book is the third component in the ROAL model it suggests a relation between language and mathematical models of totality relying on verifiability and observability objectivity models of the linguistic text In addition of the biomathematical hypothesis rules of observability and objectivity have been extended to both objective and non objective models toward a manifolded dimension of the structure within a field dimension of consciousness in which dwells the paradigm of the text as a meta observability domain for language and natural individual languages

Understanding the Generality of Mathematical

Statements Milena Damrau,2024-02-02 In this open access book Milena Damrau investigates the understanding of generality of mathematical statements in first year university students and its relation to other proof related activities Through an experimental study she particularly analyses the effect of different types of arguments empirical generic and ordinary proofs and statements familiar and unfamiliar as well as true and false ones on several proof related activities The results reveal students struggles with the concept of generality how their understanding of generality is related to proof reading and construction and how different types of arguments and statements impact students performance in other proof related activities The findings offer valuable insights for improving mathematics courses at the transition from school to university and highlight the need for more experimental studies in mathematics education *The Philosophy of Penelope Maddy* Sophia Arbeiter,Juliette Kennedy,2024-10-15 This volume features more than 20 essays that explore the work of one of the most important contemporary philosophers of mathematics It will help readers to better appreciate this significant and prolific philosopher Within philosophy of mathematics Penelope Maddy initially advocated realism She then went on to advance naturalism Both of her positions became very influential in the field along with her other work in the philosophy of logic The contributors comment on and otherwise engage with Maddy s work They also weigh in on the state of set theory and its philosophy the philosophy and history of logic naturalism skepticism and the myriad other areas to which Maddy left her mark Overall coverage traces her influence on these various ideas over the years It will also help readers to better understand how philosophers working at the forefront of these areas see these concepts today These essays will be essential reading for the wide group of philosophers working in these different areas as well as graduate students studying philosophy of mathematics and logic and the other related issues to which Maddy has contributed The volume will also appeal to logicians and set theorists in general as well as to philosophers working in analytic philosophy more widely as well as to those working in the history of philosophy *The Proceedings of the 12th International Congress on Mathematical Education* Sung Je Cho,2015-02-10 This book comprises the Proceedings of the 12th International Congress on Mathematical Education ICME 12 which was held at COEX in Seoul Korea from July 8th to 15th 2012 ICME 12 brought together 3500 experts from 92 countries working to understand all of the intellectual and attitudinal challenges in the subject of mathematics education as a multidisciplinary research and practice This work aims to serve as a platform for deeper more sensitive and more collaborative involvement of all major contributors towards educational improvement and in research on the nature of teaching and learning in mathematics education It introduces the major activities of ICME 12 which have successfully contributed to the sustainable development of mathematics education across the world The program provides food for thought and inspiration for practice for everyone with an interest in mathematics education and makes an essential reference for teacher educators curriculum developers and researchers in mathematics education The work includes the texts of the four plenary lectures and three plenary panels and reports of three survey groups five National presentations the

abstracts of fifty one Regular lectures reports of thirty seven Topic Study Groups and seventeen Discussion Groups

Proving in the Elementary Mathematics Classroom Andreas J. Stylianides, 2016-07-14 Although proving is core to mathematics as a sense making activity it currently has a marginal place in elementary classrooms internationally Blending research with practical perspectives this book addresses what it would take to elevate the place of proving at elementary school The book uses classroom episodes from two countries to examine different kinds of proving tasks and the proving activity they can generate in the elementary classroom It examines further the role of teachers in mediating the relationship between proving tasks and proving activity including major mathematical and pedagogical issues that arise for teachers as they implement each kind of proving task In addition to its contribution to research knowledge the book has important implications for teaching curricular resources and teacher education

International Perspectives on the Teaching and Learning of Geometry in Secondary Schools Patricio Herbst, Ui Hock Cheah, Philippe R. Richard, Keith Jones, 2018-04-27 This book presents current perspectives on theoretical and empirical issues related to the teaching and learning of geometry at secondary schools It contains chapters contributing to three main areas A first set of chapters examines mathematical epistemological and curricular perspectives A second set of chapters presents studies on geometry instruction and teacher knowledge and a third set of chapters offers studies on geometry thinking and learning Specific research topics addressed also include teaching practice learning trajectories learning difficulties technological resources instructional design assessments textbook analyses and teacher education in geometry Geometry remains an essential and critical topic in school mathematics As they learn geometry students develop essential mathematical thinking and visualization skills and learn a language that helps them relate to and interact with the physical world Geometry has traditionally been included as a subject of study in secondary mathematics curricula but it has also featured as a resource in out of school problem solving and has been connected to various human activities such as sports games and artwork Furthermore geometry often plays a role in teacher preparation undergraduate mathematics and at the workplace New technologies including dynamic geometry software computer assisted design software and geometric positioning systems have provided more resources for teachers to design environments and tasks in which students can learn and use geometry In this context research on the teaching and learning of geometry will continue to be a key element on the research agendas of mathematics educators as researchers continue to look for ways to enhance student learning and to understand student thinking and teachers decision making

The First Sourcebook on Asian Research in Mathematics Education - 2 Volumes Bharath Sriraman, Jinfa Cai, Kyeonghwa Lee, Lianghuo Fan, Yoshinori Shimizu, Chap Sam Lim, K. Subramaniam, 2015-08-01 Mathematics and Science education have both grown in fertile directions in different geographic regions Yet the mainstream discourse in international handbooks does not lend voice to developments in cognition curriculum teacher development assessment policy and implementation of mathematics and science in many countries Paradoxically in spite of advances in information technology and the flat earth

syndrome old distinctions and biases between different groups of researchers persist In addition limited accessibility to conferences and journals also contribute to this problem The International Sourcebooks in Mathematics and Science Education focus on under represented regions of the world and provides a platform for researchers to showcase their research and development in areas within mathematics and science education The First Sourcebook on Asian Research in Mathematics Education China Korea Singapore Japan Malaysia and India provides the first synthesized treatment of mathematics education that has both developed and is now prominently emerging in the Asian and South Asian world The book is organized in sections coordinated by leaders in mathematics education in these countries and editorial teams for each country affiliated with them The purpose of unique sourcebook is to both consolidate and survey the established body of research in these countries with findings that have influenced ongoing research agendas and informed practices in Europe North America and other countries in addition to serving as a platform to showcase existing research that has shaped teacher education curricula and policy in these Asian countries The book will serve as a standard reference for mathematics education researchers policy makers practitioners and students both in and outside Asia and complement the Nordic and NCTM perspectives *The History of Mathematical Proof in Ancient Traditions* Karine Chemla, 2012-07-05 This radical profoundly scholarly book explores the purposes and nature of proof in a range of historical settings It overturns the view that the first mathematical proofs were in Greek geometry and rested on the logical insights of Aristotle by showing how much of that view is an artefact of nineteenth century historical scholarship It documents the existence of proofs in ancient mathematical writings about numbers and shows that practitioners of mathematics in Mesopotamian Chinese and Indian cultures knew how to prove the correctness of algorithms which are much more prominent outside the limited range of surviving classical Greek texts that historians have taken as the paradigm of ancient mathematics It opens the way to providing the first comprehensive textually based history of proof Challenges and Strategies in Teaching Linear Algebra Sepideh Stewart, Christine Andrews-Larson, Avi Berman, Michelle Zandieh, 2018-02-01 This book originated from a Discussion Group Teaching Linear Algebra that was held at the 13th International Conference on Mathematics Education ICME 13 The aim was to consider and highlight current efforts regarding research and instruction on teaching and learning linear algebra from around the world and to spark new collaborations As the outcome of the two day discussion at ICME 13 this book focuses on the pedagogy of linear algebra with a particular emphasis on tasks that are productive for learning The main themes addressed include theoretical perspectives on the teaching and learning of linear algebra empirical analyses related to learning particular content in linear algebra the use of technology and dynamic geometry software and pedagogical discussions of challenging linear algebra tasks Drawing on the expertise of mathematics education researchers and research mathematicians with experience in teaching linear algebra this book gathers work from nine countries Austria Germany Israel Ireland Mexico Slovenia Turkey the USA and Zimbabwe Tainted Kristin Sharon Shrader-Frechette, 2014 Three

fourths of scientific research in the United States is funded by special interests. Many of these groups have specific practical goals such as developing pharmaceuticals or establishing that a pollutant causes only minimal harm. For groups with financial conflicts of interest, their scientific findings often can be deeply flawed. To uncover and assess these scientific flaws, award-winning biologist and philosopher of science Kristin Shrader-Frechette uses the analytical tools of classic philosophy of science. She identifies and evaluates the concepts, data, inferences, methods, models, and conclusions of science tainted by the influence of special interests. As a result, she challenges accepted scientific findings regarding risks such as chemical toxins and carcinogens, ionizing radiation, pesticides, hazardous waste disposal, development of environmentally sensitive lands, threats to endangered species, and less protective standards for workplace pollution exposure. In so doing, she dissects the science on which many contemporary scientific controversies turn. Demonstrating and advocating liberation science, she shows how practical, logical, methodological, and ethical evaluations of science can both improve its quality and credibility and protect people from harm caused by flawed science, such as underestimates of cancers caused by bovine growth hormones, cell phones, fracking, or high voltage wires. This book is both an in-depth look at the unreliable scientific findings at the root of contemporary debates in biochemistry, ecology, economics, hydrogeology, physics, and zoology and a call to action for scientists, philosophers of science, and all citizens.

Proceedings of The 6th MAC 2016 Group of authors, 2016-02-16 Proceedings of The 6th MAC 2016 The 6th Multidisciplinary Academic Conference in Prague 2016

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