

## Mathematics Memo November 2013 Paper 2

This book, *Teaching Learners with Visual Impairment*, focuses on holistic support to learners with visual impairment in and beyond the classroom and school context. Special attention is given to classroom practice, learning support, curriculum differentiation and assessment practices, to mention but a few areas of focus covered in the book. In this manner, this book makes a significant contribution to the existing body of knowledge on the implementation of inclusive education policy with learners affected by visual impairment.

Descriptive set theory is mainly concerned with studying subsets of the space of all countable binary sequences. In this paper the authors study the generalization where countable is replaced by uncountable. They explore properties of generalized Baire and Cantor spaces, equivalence relations and their Borel reducibility. The study shows that the descriptive set theory looks very different in this generalized setting compared to the classical, countable case. They also draw the connection between the stability theoretic complexity of first-order theories and the descriptive set theoretic complexity of their isomorphism relations. The authors' results suggest that Borel reducibility on uncountable structures is a model theoretically natural way to compare the complexity of isomorphism relations.

The main goals of this paper are: (i) To develop an abstract differential calculus on metric measure spaces by investigating the duality relations between differentials and gradients of Sobolev functions. This will be achieved without calling into play any sort of analysis in charts, our assumptions being: the metric space is complete and separable and the measure is Radon and non-negative. (ii) To employ these notions of calculus to provide, via integration by parts, a general definition of distributional Laplacian, thus giving a meaning to an expression like  $\int \phi \Delta u$ , where  $\phi$  is a function and  $\mu$  is a measure. (iii) To show that on spaces with Ricci curvature bounded from below and dimension bounded from above, the Laplacian of the distance function is always a measure and that this measure has the standard sharp comparison properties. This result requires an additional assumption on the space, which reduces to strict convexity of the norm in the case of smooth Finsler structures and is always satisfied on spaces with linear Laplacian, a situation which is analyzed in detail.

In this article the authors study Hamiltonian flows associated to smooth functions  $R \rightarrow R$  restricted to energy levels close to critical levels. They assume the existence of a saddle-center equilibrium point in the zero energy level  $E_0$ . The Hamiltonian function near  $E_0$  is assumed to satisfy Moser's normal form and is assumed to lie in a strictly convex singular subset of  $E_0$ . Then for all  $\epsilon > 0$  small, the energy level  $E_\epsilon$  contains a subset near  $E_0$ , diffeomorphic to the closed  $2n$ -ball, which admits a system of transversal sections  $\Sigma_\epsilon$ , called a foliation.  $\Sigma_\epsilon$  is a singular foliation of  $E_\epsilon$  and contains two periodic orbits and  $2n-2$  binding orbits.  $\Sigma_\epsilon$  is the Lyapunoff orbit lying in the center manifold of  $E_0$ , has Conley-Zehnder index  $2n-2$  and spans two rigid planes in  $E_\epsilon$ .  $\Sigma_\epsilon$  has Conley-Zehnder index  $2n-2$  and spans a one parameter family of planes in  $E_\epsilon$ . A rigid cylinder connecting  $\Sigma_\epsilon$  to  $E_0$  completes  $\Sigma_\epsilon$ . All regular leaves are transverse to the Hamiltonian vector field. The existence of a homoclinic orbit to  $E_0$  in  $E_\epsilon$  follows from this foliation.

The entire collection of Martin Gardner's Scientific American columns are on one searchable CD! Martin Gardner's "Mathematical Games" column ran in Scientific American from 1956 to 1986. In these columns, Gardner introduced hundreds of thousands of readers to the delights of mathematics and of puzzles and problem solving. His column broke such stories as Rivest, Shamir and Adelman on public-key cryptography, Mandelbrot on fractals, Conway on Life, and Penrose on tilings. He enlivened classic geometry and number theory and introduced readers to new areas such as combinatorics and graph theory. The CD contains the following articles: (1) Hexaflexagons and Other Mathematical Diversions; (2) The Second Scientific American Book of Mathematical Puzzles and Diversions; (3) New Mathematical

Diversions; (4) The Unexpected Hanging and Other Mathematical Diversions; (5) Martin Gardner's 6th Book of Mathematical Diversions from Scientific American; (6) Mathematical Carnival; (7) Mathematical Magic Show; (8) Mathematical Circus; (9) The Magic Numbers of Dr. Matrix; (10) Wheels, Life, and Other Mathematical Amusements; (11) Knotted Doughnuts and Other Mathematical Entertainers; (12) Time Travel and Other Mathematical Bewilderments; (13) Penrose Tiles to Trapdoor Ciphers; (14) Fractal Music, Hypercards, and more Mathematical Recreations from Scientific American and (15) The Last Recreations: Hydras, Eggs, and Other Mathematical Mystifications. A profile and interview with Martin Gardner is included in this collection.

The authors consider a parabolic problem with degeneracy in the interior of the spatial domain, and they focus on observability results through Carleman estimates for the associated adjoint problem. The novelties of the present paper are two. First, the coefficient of the leading operator only belongs to a Sobolev space. Second, the degeneracy point is allowed to lie even in the interior of the control region, so that no previous result can be adapted to this situation; however, different cases can be handled, and new controllability results are established as a consequence.

There are several generalizations of the classical theory of Sobolev spaces as they are necessary for the applications to Carnot-Carathéodory spaces, subelliptic equations, quasiconformal mappings on Carnot groups and more general Loewner spaces, analysis on topological manifolds, potential theory on infinite graphs, analysis on fractals and the theory of Dirichlet forms. The aim of this paper is to present a unified approach to the theory of Sobolev spaces that covers applications to many of those areas. The variety of different areas of applications forces a very general setting. We are given a metric space  $X$  equipped with a doubling measure  $\mu$ . A generalization of a Sobolev function and its gradient is a pair  $u \in L^1_{\text{loc}}(X)$ ,  $0 \leq g \in L^p(X)$  such that for every ball  $B \subset X$  the Poincaré-type inequality  $\int_B |u - u_B| \, d\mu \leq C r (\int_{\sigma B} g^p \, d\mu)^{1/p}$ , holds, where  $r$  is the radius of  $B$  and  $|\sigma| \geq 1$ ,  $C > 0$  are fixed constants. Working in the above setting we show that basically all relevant results from the classical theory have their counterparts in our general setting. These include Sobolev-Poincaré type embeddings, Rellich-Kondrachov compact embedding theorem, and even a version of the Sobolev embedding theorem on spheres. The second part of the paper is devoted to examples and applications in the above mentioned areas.

Let  $G$  be a simple classical algebraic group over an algebraically closed field of characteristic  $p$  with natural module  $V$ . Let  $H$  be a closed subgroup of  $G$  and let  $W$  be a nontrivial  $H$ -restricted irreducible tensor indecomposable rational  $H$ -module such that the restriction of  $W$  to  $H$  is irreducible. In this paper the authors classify the triples of this form, where  $H$  is a disconnected almost simple positive-dimensional closed subgroup of  $G$  acting irreducibly on  $V$ . Moreover, by combining this result with earlier work, they complete the classification of the irreducible triples where  $G$  is a simple algebraic group over  $\mathbb{C}$ , and  $H$  is a maximal closed subgroup of positive dimension.

America's nuclear energy industry is in decline. Low natural gas prices, financing hurdles, failure to find a permanent repository for high-level nuclear waste, reactions to the Fukushima accident in Japan, and other factors are hastening the day when existing U.S. reactors become uneconomic. The decline of the U.S. nuclear energy industry could be much more rapid than policy makers and stakeholders anticipate.

Revised second edition aligned for the 2008-2009 testing cycle, with a full index. REA's MCAS Grade 10 Mathematics provides all the instruction and practice students need to excel on this high-stakes exam. The book contains all test components that students

will encounter on the official exam: Number Sense and Operations; Data Analysis; Probability and Statistics; Geometry; Measurement; and Patterns, Relations and Algebra. 2 full-length practice tests measure learning and progress, and confidence-building drills boost test-day readiness. DETAILS: -Fully aligned with the official state exam -2 full-length practice tests -Drills help students organize, comprehend, and practice -Lessons enhance necessary mathematics skills -Confidence-building tips reduce test anxiety and boost test-day readiness REA ... Real review, Real practice, Real results.

The Commonwealth of Independent States (CIS) is a regional organization that formed during the breakup of the Soviet Union in 1991. It has few supranational powers, but aims to be more than a purely symbolic organization, nominally possessing coordinating powers in the realm of trade, finance, lawmaking, and security. As such, it is vital to examine this region and its economic and geopolitical impacts on the world. Economic and Geopolitical Perspectives of the Commonwealth of Independent States and Eurasia is a vital research publication that explores the importance and influence of the Commonwealth of Independent States and Eurasia in the twenty-first century. Highlighting a wide range of topics such as sovereign democracy, economic integration, and foreign policy, this book is geared toward business managers, economists, business professionals, entrepreneurs, business analysts, and researchers seeking current research on the effects of political organizations like the CIS on various regions.

This collection of essays honors the life and work of one of the most prominent and fervent heterodox economists, Frederic S. Lee, who has been at the heart of the heterodox economics movements for the past three decades. Authors in this book demonstrate that heterodox economic has transcended the criticism of mainstream economics and, more importantly, that constructive developments are in the making by way of cross-communications among various heterodox economics traditions. Frederic S. Lee's contributions to heterodox economics are centered on three themes: the making of a history and identity of heterodox economics, heterodox microeconomics, and the heterodox analysis of social provisioning. Part I addresses the importance of history, theory, research methods, and institutions in the making of the identity of heterodox economics as an alternative to mainstream economics. Part II delves into heterodox microeconomic theories—in particular, investment, pricing, competition, markets, and market governance—as foundations of heterodox macroeconomic analyses. Part III expands the analysis of the capitalist social provisioning process with an emphasis on its subsystems and their relationships over historical time. Part IV encapsulates the life and work of Frederic S. Lee. Throughout his intellectual life Frederic S. Lee has shown to many that the development of heterodox economics is rendered possible by unselfish and ceaseless efforts to build both theory and institutions. Essays in this book attest that establishing an alternative critical theory to the status quo is not only possible but also serviceable to the majority of the population.

This two-volume set explores in-depth the economic origins and repercussions of the Arab Spring revolts. Volume 1 of The Arab Spring Five Years Later is based on extensive research conducted by scholars from a variety of backgrounds, including many associated with the Japan International Cooperation Agency (JICA). The original research papers are gathered in volume 2 and

are available for readers who wish to go even further in understanding the economic background of the Arab Spring. Papers examine women's issues and agricultural practices in Morocco; urban transportation, small enterprises, governance, and inclusive planning in Egypt; reconstruction in Iraq; youth employment in Tunisia; education in Yemen; and more. In addition to Hafez Ghanem, contributors include Mongi Boughzala (University of Tunis ElManar, Tunisia), Mohamed Tlili Hamdi (University of Sfax, Tunisia), Yuriko Kameyama (JICA), Hideki Matsunaga (JICA), Mayada Magdy (JICA), Yuko Morikawa (JICA), Akira Murata (JICA), Kei Sakamoto (JICA), Seiki Tanaka (JICA), Masanori Yoshikawa (JICA), and Takako Yuki (JICA).

In this paper the authors provide an extension of the theory of descent of Ginzburg-Rallis-Soudry to the context of essentially self-dual representations, that is, representations which are isomorphic to the twist of their own contragredient by some Hecke character. The authors' theory supplements the recent work of Asgari-Shahidi on the functorial lift from (split and quasisplit forms of)  $GS_{2n}$  to  $GL_{2n}$ .

The little  $-$ disks operad,  $\mathcal{L}_d$ , along with its variants, is an important tool in homotopy theory. It is defined in terms of configurations of disjoint  $d$ -dimensional disks inside the standard unit disk in  $\mathbb{C}$  and it was initially conceived for detecting and understanding  $d$ -fold loop spaces. Its many uses now stretch across a variety of disciplines including topology, algebra, and mathematical physics. In this paper, the authors develop the details of Kontsevich's proof of the formality of little  $-$ disks operad over the field of real numbers. More precisely, one can consider the singular chains on  $\mathcal{L}_d$  as well as the singular homology of  $\mathcal{L}_d$ . These two objects are operads in the category of chain complexes. The formality then states that there is a zig-zag of quasi-isomorphisms connecting these two operads. The formality also in some sense holds in the category of commutative differential graded algebras. The authors additionally prove a relative version of the formality for the inclusion of the little  $-$ disks operad in the little  $-$ disks operad when  $d < n$ .

Awareness has been growing in the United States - and in nations around the world - that the Chinese Communist Party (CCP) has triggered a new era of great-power competition. Yet few discern the pattern in China's inroads within every region of the world, much less the specific form of dominance to which the party aspires. The CCP aims not merely at preeminence within the established world order - an order that is grounded in free and sovereign nation-states, flows from the universal principles on which America was founded, and advances U.S. national interests - but to fundamentally revise world order, placing the People's Republic of China (PRC) at the center and serving Beijing's authoritarian goals and hegemonic ambitions. In the face of the China challenge, the United States must secure freedom. China is a challenge because of its conduct. Modeled on 20th-century Marxist-Leninist dictatorship, the CCP eventually spurred rapid modernization and produced prodigious economic growth - thanks in no small measure to the party's decision in the late 1970s to embrace free-market elements and to the decision by the United States and nations around the world to engage, and welcome commerce with, China. The party today wields its economic power to co-opt and coerce countries around the world; make the societies and politics of foreign nations more accommodating to CCP specifications; and reshape international organizations in line with China's brand of socialism. At the same time, the CCP is developing a world-class military to rival and eventually surpass the U.S. military. These actions enable the CCP to credibly pursue

the quest - proceeding outward through the Indo-Pacific region and encompassing the globe - to achieve "national rejuvenation" culminating in the transformation of the international order. To understand China's peculiar form of authoritarianism and the hegemonic goals to which it gives rise, it is necessary to grasp the intellectual sources from which China's conduct springs: the CCP's Marxist-Leninist beliefs and the party's extreme interpretation of Chinese nationalism.

This second edition introduces an additional set of new mathematical problems with their detailed solutions in real analysis. It also provides numerous improved solutions to the existing problems from the previous edition, and includes very useful tips and skills for the readers to master successfully. There are three more chapters that expand further on the topics of Bernoulli numbers, differential equations and metric spaces. Each chapter has a summary of basic points, in which some fundamental definitions and results are prepared. This also contains many brief historical comments for some significant mathematical results in real analysis together with many references. Problems and Solutions in Real Analysis can be treated as a collection of advanced exercises by undergraduate students during or after their courses of calculus and linear algebra. It is also instructive for graduate students who are interested in analytic number theory. Readers will also be able to completely grasp a simple and elementary proof of the Prime Number Theorem through several exercises. This volume is also suitable for non-experts who wish to understand mathematical analysis. Request Inspection Copy Contents: Sequences and Limits Infinite Series Continuous

Functions Differentiation Integration Improper Integrals Series of Functions Approximation by Polynomials Convex Functions Various Proof  $\zeta(2) = \pi^2/6$  Functions of Several Variables Uniform Distribution Rademacher Functions Legendre Polynomials Chebyshev Polynomials Gamma Function Prime Number Theorem Bernoulli Numbers Metric Spaces Differential Equations Readership: Undergraduates and graduate students in mathematical analysis.

In the wrong hands, math can be deadly. Even the simplest numbers can become powerful forces when manipulated by politicians or the media, but in the case of the law, your liberty -- and your life -- can depend on the right calculation. In *Math on Trial*, mathematicians Leila Schneps and Coralie Colmez describe ten trials spanning from the nineteenth century to today, in which mathematical arguments were used -- and disastrously misused -- as evidence. They tell the stories of Sally Clark, who was accused of murdering her children by a doctor with a faulty sense of calculation; of nineteenth-century tycoon Hetty Green, whose dispute over her aunt's will became a signal case in the forensic use of mathematics; and of the case of Amanda Knox, in which a judge's misunderstanding of probability led him to discount critical evidence -- which might have kept her in jail. Offering a fresh angle on cases from the nineteenth-century Dreyfus affair to the murder trial of Dutch nurse Lucia de Berk, Schneps and Colmez show how the improper application of mathematical concepts can mean the difference between walking free and life in prison. A colorful narrative of mathematical abuse, *Math on Trial* blends courtroom drama, history, and math to show that legal expertise isn't always enough to prove a person innocent.

On the occasion of the International Conference on Nonlinear Hyperbolic Problems held in St. Etienne, France, 1986 it was decided to start a two years cycle of conferences on this very rapidly expanding branch of mathematics and its applications in

Continuum Mechanics and Aerodynamics. The second conference took place in Aachen, FRG, March 14-18, 1988. The number of more than 200 participants from more than 20 countries all over the world and about 100 invited and contributed papers, well balanced between theory, numerical analysis and applications, do not leave any doubt that it was the right decision to start this cycle of conferences, of which the third will be organized in Sweden in 1990. This volume contains sixty eight original papers presented at the conference, twenty two of them dealing with the mathematical theory, e.g. existence, uniqueness, stability, behaviour of solutions, physical modelling by evolution equations. Twenty two articles in numerical analysis are concerned with stability and convergence to the physically relevant solutions such as schemes especially devised for treating shocks, contact discontinuities and artificial boundaries. Twenty four papers contain multidimensional computational applications to nonlinear waves in solids, flow through porous media and compressible fluid flow including shocks, real gas effects, multiphase phenomena, chemical reactions etc. The editors and organizers of the Second International Conference on Hyperbolic Problems would like to thank the Scientific Committee for the generous support of recommending invited lectures and selecting the contributed papers of the conference.

In this paper the authors start with the construction of the symplectic field theory (SFT). As a general theory of symplectic invariants, SFT has been outlined in Introduction to symplectic field theory (2000), by Y. Eliashberg, A. Givental and H. Hofer who have predicted its formal properties. The actual construction of SFT is a hard analytical problem which will be overcome by means of the polyfold theory due to the present authors. The current paper addresses a significant amount of the arising issues and the general theory will be completed in part II of this paper. To illustrate the polyfold theory the authors use the results of the present paper to describe an alternative construction of the Gromov-Witten invariants for general compact symplectic manifolds.

This anthology presents a comprehensive review of mathematics and its teaching in the following nations in South America, Central America, and the Caribbean: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Guyana, Haiti, Honduras, México, Panamá, Paraguay, Perú, Puerto Rico, Trinidad and Tobago, and Venezuela. The last summary of mathematics education encompassing countries from the Southern Americas appeared in 1966. Progress in the field during five decades has remained unexamined until now. Contents: ARGENTINA: A Review of Mathematics Education through Mathematical Problems at the Secondary Level (Betina Duarte) BOLIVIA: An Approach to Mathematics Education in the Plurinational State (A. Páez) BRAZIL: History and Trends in Mathematics Education (Beatriz S. D'Ambrosio, Juliana Martins, and Viviane de Oliveira Santos) CHILE: The Context and Pedagogy of Mathematics Teaching and Learning (Eliana D. Rojas and Fidel Oteiza) COLOMBIA: The Role of Mathematics in the Making of a Nation (Hernando J. Echeverri and Angela M. Restrepo) COSTA RICA: History and Perspectives on Mathematics and Mathematics Education (Ángel Ruiz) CUBA: Mathematics and Its Teaching (Otilio B. Mederos Anoceto, Miguel A. Jiménez Pozo, and José M. Sigarreta) GUYANA: The Mathematical Growth of an Emerging Nation (Mahendra Singh and Lenox Allicock) HAITI: History of Mathematics Education (Jean W. Richard) HONDURAS: Origins, Development, and Challenges in the Teaching of Mathematics (Marvin Roberto Mendoza Valencia) MÉXICO: The History and Development of a Nation and Its

Influence on the Development of Mathematics and Mathematics Education (Eduardo Mancera and Alicia Ávila) PANAMÁ: Towards the First World through Mathematics (Euclides Samaniego, Nicolás A Samaniego, and Benigna Fernández) PARAGUAY: A Review of the History of Mathematics and Mathematics Education (Gabriela Gómez Pasquali) PERÚ: A Look at the History of Mathematics and Mathematics Education (César Carranza Saravia and Uldarico Malaspina Jurado) PUERTO RICO: The Forging of a National Identity in Mathematics Education (Héctor Rosario, Daniel McGee, Jorge M López, Ana H Quintero, and Omar A Hernández) TRINIDAD and TOBAGO: Mathematics Education in the Twin Island Republic (Shereen Alima Khan and Vimala Judy Kamalodeen) VENEZUELA: Signs for the Historical Reconstruction of Its Mathematics Education (Fredy Enrique González)

Readership: Graduates and professionals in mathematics education; education planners. Key Features: Featured introduction by Professor Ubiratàn D'Ambrosio of Brazil — the most prestigious of Latin American mathematics educators Insights into the impact of political changes of mathematics education in Cuba, Venezuela, Brazil etc. Historical references, not available elsewhere, are covered in this book

Keywords: Mathematics; Mathematics Teaching; South America; Central America; Caribbean; Mathematics Curriculum; History of Mathematics; Mathematics Education; Pedagogy in Mathematics

Longlisted for the National Book Award New York Times Bestseller A former Wall Street quant sounds an alarm on the mathematical models that pervade modern life -- and threaten to rip apart our social fabric We live in the age of the algorithm. Increasingly, the decisions that affect our lives--where we go to school, whether we get a car loan, how much we pay for health insurance--are being made not by humans, but by mathematical models. In theory, this should lead to greater fairness: Everyone is judged according to the same rules, and bias is eliminated. But as Cathy O'Neil reveals in this urgent and necessary book, the opposite is true. The models being used today are opaque, unregulated, and uncontestable, even when they're wrong. Most troubling, they reinforce discrimination: If a poor student can't get a loan because a lending model deems him too risky (by virtue of his zip code), he's then cut off from the kind of education that could pull him out of poverty, and a vicious spiral ensues. Models are propping up the lucky and punishing the downtrodden, creating a "toxic cocktail for democracy." Welcome to the dark side of Big Data. Tracing the arc of a person's life, O'Neil exposes the black box models that shape our future, both as individuals and as a society. These "weapons of math destruction" score teachers and students, sort resumes, grant (or deny) loans, evaluate workers, target voters, set parole, and monitor our health. O'Neil calls on modelers to take more responsibility for their algorithms and on policy makers to regulate their use. But in the end, it's up to us to become more savvy about the models that govern our lives. This important book empowers us to ask the tough questions, uncover the truth, and demand change. -- Longlist for National Book Award (Non-Fiction) -- Goodreads, semi-finalist for the 2016 Goodreads Choice Awards (Science and Technology) -- Kirkus, Best Books of 2016 -- New York Times, 100 Notable Books of 2016 (Non-Fiction) -- The Guardian, Best Books of 2016 -- WBUR's "On Point," Best Books of 2016: Staff Picks -- Boston Globe, Best Books of 2016, Non-Fiction

Motivation makes all the difference. And what's more motivating than the expectation of success? The instructions are clear and to the point, so students can quickly get down to writing practice in these 64-page worktexts. Helpful prompts pack the worktext

lesson pages including illustrations, examples, and sample responses. Sample Content: book and movie reviews, travelogue, a character sketch, fashions.

Let  $G$  be a simple classical algebraic group over an algebraically closed field of characteristic with natural module  $V$ . Let  $H$  be a closed subgroup of  $G$  and let  $W$  be a non-trivial irreducible tensor-indecomposable  $H$ -restricted rational  $V$ -module such that the restriction of  $W$  to  $H$  is irreducible. In this paper the authors classify the triples of this form, where  $H$  is a disconnected maximal positive-dimensional closed subgroup of  $G$  preserving a natural geometric structure on  $V$ .

The author proves Kontsevich's form of the mirror symmetry conjecture for (on the symplectic geometry side) a quartic surface in  $\mathbb{C}^3$ .

The field of design research has been gaining momentum over the last five years, particularly in educational studies. As papers and articles have grown in number, definition of the domain is now beginning to standardise. This book fulfils a growing need by providing a synthesised assessment of the use of development research in education. It looks at four main elements: background information including origins, definitions of development research, description of applications and benefits and risks associated with studies of this kind how the approach can serve the design of learning environments and educational technology quality assurance - how to safeguard academic rigor while conducting design and development studies a synthesis and overview of the topic along with relevant reflections.

The curvature discussed in this paper is a far reaching generalization of the Riemannian sectional curvature. The authors give a unified definition of curvature which applies to a wide class of geometric structures whose geodesics arise from optimal control problems, including Riemannian, sub-Riemannian, Finsler and sub-Finsler spaces. Special attention is paid to the sub-Riemannian (or Carnot–Carathéodory) metric spaces. The authors' construction of curvature is direct and naive, and similar to the original approach of Riemann. In particular, they extract geometric invariants from the asymptotics of the cost of optimal control problems. Surprisingly, it works in a very general setting and, in particular, for all sub-Riemannian spaces.

For any cluster algebra whose underlying combinatorial data can be encoded by a bordered surface with marked points, the authors construct a geometric realization in terms of suitable decorated Teichmüller space of the surface. On the geometric side, this requires opening the surface at each interior marked point into an additional geodesic boundary component. On the algebraic side, it relies on the notion of a non-normalized cluster algebra and the machinery of tropical lambda lengths. The authors' model allows for an arbitrary choice of coefficients which translates into a choice of a family of integral laminations on the surface. It provides an intrinsic interpretation of cluster variables as renormalized lambda lengths of arcs on the surface. Exchange relations are written in terms of the shear coordinates of the laminations and are interpreted as generalized Ptolemy relations for lambda lengths. This approach gives alternative proofs for the main structural results from the authors' previous paper, removing unnecessary assumptions on the surface.

The authors study the Cauchy problem for the one-dimensional wave equation  $\partial_t^2 u(t,x) - \partial_x^2 u(t,x) + V(x)u(t,x) = 0$ . The potential  $V$  is

assumed to be smooth with asymptotic behavior  $V(x) \sim |x|^2$  as  $|x| \rightarrow \infty$ . They derive dispersive estimates, energy estimates, and estimates involving the scaling vector field  $t\partial_t + x\partial_x$ , where the latter are obtained by employing a vector field method on the “distorted” Fourier side. In addition, they prove local energy decay estimates. Their results have immediate applications in the context of geometric evolution problems. The theory developed in this paper is fundamental for the proof of the co-dimension 1 stability of the catenoid under the vanishing mean curvature flow in Minkowski space; see Donninger, Krieger, Szeftel, and Wong, “Codimension one stability of the catenoid under the vanishing mean curvature flow in Minkowski space”, preprint arXiv:1310.5606 (2013).

Predictive policing is the use of analytical techniques to identify targets for police intervention with the goal of preventing crime, solving past crimes, or identifying potential offenders and victims. These tools are not a substitute for integrated approaches to policing, nor are they a crystal ball. This guide assesses some of the most promising technical tools and tactical approaches for acting on predictions in an effective way.

The authors consider the original strategy proposed by Sudakov for solving the Monge transportation problem with norm cost with  $\mu, \nu$  probability measures in  $\mathbb{R}^n$  and absolutely continuous w.r.t.  $\mathcal{H}^n$ . The key idea in this approach is to decompose (via disintegration of measures) the Kantorovich optimal transportation problem into a family of transportation problems in  $\mathbb{R}^n$ , where  $\Omega_i$  are disjoint regions such that the construction of an optimal map is simpler than in the original problem, and then to obtain  $T$  by piecing together the maps  $T_i$ . When the norm is strictly convex, the sets  $\Omega_i$  are a family of  $k$ -dimensional segments determined by the Kantorovich potential called optimal rays, while the existence of the map is straightforward provided one can show that the disintegration of  $\mu$  (and thus of  $\nu$ ) on such segments is absolutely continuous w.r.t. the  $k$ -dimensional Hausdorff measure. When the norm is not strictly convex, the main problems in this kind of approach are two: first, to identify a suitable family of regions on which the transport problem decomposes into simpler ones, and then to prove the existence of optimal maps. In this paper the authors show how these difficulties can be overcome, and that the original idea of Sudakov can be successfully implemented. The results yield a complete characterization of the Kantorovich optimal transportation problem, whose straightforward corollary is the solution of the Monge problem in each set and then in  $\mathbb{R}^n$ . The strategy is sufficiently powerful to be applied to other optimal transportation problems.

A note to readers: This book is in French. The text has two chapters. The first one, written by Waldspurger, proves a twisted version of the local trace formula of Arthur over a local field. This formula is an equality between two expressions, one involving weighted orbital integrals, the other one involving weighted characters. The authors follow Arthur's proof, but the treatment of the spectral side is more complicated in the twisted situation. They need to use the combinatorics of the “Morning Seminar”. The authors' local trace formula has the same consequences as in Arthur's paper on elliptic characters. The second chapter, written by Mœglin, gives a symmetric form of the local trace formula as in Arthur's paper on Fourier Transform of Orbital integral and describes any twisted orbital integral, in the  $p$ -adic case, as integral of characters.

A hilarious reeducation in mathematics-full of joy, jokes, and stick figures-that sheds light on the countless practical and wonderful

ways that math structures and shapes our world. In *Math With Bad Drawings*, Ben Orlin reveals to us what math actually is; its myriad uses, its strange symbols, and the wild leaps of logic and faith that define the usually impenetrable work of the mathematician. Truth and knowledge come in multiple forms: colorful drawings, encouraging jokes, and the stories and insights of an empathetic teacher who believes that math should belong to everyone. Orlin shows us how to think like a mathematician by teaching us a brand-new game of tic-tac-toe, how to understand an economic crisis by rolling a pair of dice, and the mathematical headache that ensues when attempting to build a spherical Death Star. Every discussion in the book is illustrated with Orlin's trademark "bad drawings," which convey his message and insights with perfect pitch and clarity. With 24 chapters covering topics from the electoral college to human genetics to the reasons not to trust statistics, *Math with Bad Drawings* is a life-changing book for the math-estranged and math-enamored alike.

The purpose of this book is to collect, organize and disseminate collective wisdom with respect to designing, conducting, and publishing quality research in mathematics education. This wisdom will be gleaned from among those who, over the past several decades, have been instrumental in guiding the field in the pursuit of excellence in mathematics education research—insightful editors, educative reviewers, prolific writers, and caring mentors. Each chapter is written to the novice researcher with the intent of aiding them in avoiding common pitfalls, navigating difficult intellectual terrain, and understanding that they are not alone in experiencing rejection, frustration, confusion, and doubt. This book differs from existing literature in the sense that it is written about the enterprise of designing, conducting and publishing research in mathematics education as opposed to being reports of the results of such work. It also differs in the sense that it is written with the intent to mentor the rising generation as opposed to capture the state of the field (as would happen in a handbook, for example). It is written for the express purpose of helping the field work collectively to aid in the often isolated enterprise of mentoring new researchers. The primary audience is a potentially wide one: graduate students, novice researchers, graduate faculty, advisors, and mentors – or anyone seeking to improve their own abilities to design, conduct, and publish quality research in mathematics education.

In *Evidence, Politics, and Education Policy*, political scientists Lorraine M. McDonnell and M. Stephen Weatherford provide an original analysis of evidence use in education policymaking to help scholars and advocates shape policy more effectively. The book shows how multiple types of evidence are combined as elected officials and their staffs work with researchers, advocates, policy entrepreneurs, and intermediary organizations to develop, create, and implement education policies. *Evidence, Politics, and Education Policy* offers an in-depth understanding of the political environment in which evidence is solicited and used. Two key case studies inform the book's findings. The primary case—a major, multimethod study—examines the development and early implementation of the Common Core State Standards at the national level and in four states: California, Indiana, Massachusetts, and Tennessee. A comparative case analyzes the evidence used in Congressional hearings over the twenty-year history of the Children's Health Insurance Program. Together, the two cases illustrate the conditions under which different types of evidence are used and, in particular, how federalism, the complexity of the policy problem, and the policy's maturity shape evidence use.

McDonnell and Weatherford focus on three leverage points for strengthening the use of research evidence in education policy: integrating research findings with value-based policy ideas; designing policies with incentives for research use built into their rules and organizational structures; and training policy analysts to promote the use of research in policymaking venues.

This is the second paper in the series of papers dedicated to the study of natural cluster structures in the rings of regular functions on simple complex Lie groups and Poisson–Lie structures compatible with these cluster structures. According to our main conjecture, each class in the Belavin–Drinfeld classification of Poisson–Lie structures on corresponds to a cluster structure in . The authors have shown before that this conjecture holds for any in the case of the standard Poisson–Lie structure and for all Belavin–Drinfeld classes in , . In this paper the authors establish it for the Cremmer–Gervais Poisson–Lie structure on , which is the least similar to the standard one.

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