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وزارة التربية والتعليم والتعليم العالي
Ministry of Education and Higher Education
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Q A T A R

MATH DAY

يوم قطر للرياضيات

11th Nov 2024, Monday

Ministry of Education & Higher Education, Doha, Qatar

Qatar Math Day 4

Program

Abstracts

Time	Program		Location		
8:00am – 8:30am	Registration		Building 2		
8:30am – 8:45am	Opening		Auditorium Building 2		
8:45am – 9:35am	<p>Keynote 1: Nader Masmoudi, Hydrodynamic Paradoxes <i>Courant Institute of Mathematical Sciences at New York University, and NYUAD (Abu Dhabi)</i></p>				
9:35am – 10:25am	<p>Keynote 2: Adi Nur Cahyono, Learning Math All Around Us in the Digital Age — from Real-World Trails to Immersive Adventures <i>Universitas Negeri Semarang UNNES</i></p>				
10:25am – 10:40am	Coffee Break – Building 5				
Parallel Sessions					
Parallel Seminars			Parallel Workshops		
10:40am-11:10am	<p>T1: Lecture Hall 1 Convexity and applications Mohamed Majdoub</p>	<p>T2: Lecture Hall 5 A best proximity point theorem for C-class-proximal non-self-mappings and applications to an integrodifferential system of equations Iyadh Ayari</p>	<p>W1: Lecture Hall 2 Effective Classroom Dialogue - The Art of Engaging Students in Math Learning Khaled Moqdad</p>	<p>W2: Training Room 1 Interactive techniques for developing students' skills in Mathematics practices Fatma Al-Hassan</p>	<p>W3: Training Room 2 Artificial Intelligence in Math Ans Abu Joudah</p>
	<p>T3: Lecture Hall 1 Performance Comparison of Variable-Stepsize Methods on Advection-Diffusion-Reaction Models. Raed Marabeh</p>	<p>T4: Lecture Hall 5 The origin of Lie symmetry methods for differential equations and the rise of abstract Lie algebras. Ryad Ghanam</p>			

11:40am -1:00pm Prayers and Lunch Break – Building 5					
1:00pm-1:30pm	T5: Lecture Hall 1 Emotional intelligence skills in math lessons Sarii Baathi	T6: Lecture Hall 5 Principles of creative solution theory to enhance math practices Hiba Jadaan	W4: Lecture Hall 2 Binomial Theorem for Matrices Loai Jebрил	W5: Training Room 1 Creative Solutions: Employing Inequalities in Math Education Abdelouahed Hamdi	W6: Training Room 2 Math Trails with Digital Technology Adi Nur Cohyeno
1:30pm-2:00pm	T7: Lecture Hall 1 Optimal adaptive control for a plug flow reactor by integral reinforcement learning Ilyasse Aksikas	T8: Lecture Hall 5 Developing habits of mind and their role in math Lubna Rawashdeh			
2:00pm – 2:30pm	T9: Lecture Hall 1 Mathematics and AI in Healthcare: Advancing Stroke diagnosis through Precise Segmentation Techniques Mohamed Mabrok	T10: Lecture Hall 5 Spectral properties of the Cauchy transform on modified Bergman Khaled Chbichib	W7: Lecture Hall 2 تحديات تدريس الرياضيات Mohamed Majdoub	W8: Training Room 1 Spotting the error as a strategy in teaching algebra Houssam Kasti	W9: Training Room 2 Introduction to the VRA approach to teaching math Tasneem Ayash
2:30pm – 3:00pm	T11: Lecture Hall 1 Regularity of the transport density in the import/export transport problem Samer Dweik	T12: Lecture Hall 5 Leveraging Mathematics to Address AI and Security Challenges Samir Belhaouari			

Abstracts

Session	Speaker, Title	Abstract
M1	Prof. Nader Masmoudi, <i>Hydrodynamic Paradoxes</i>	A paradox usually refers to an unexpected statement that sharply contradicts a generally accepted opinion. We will review some of the famous paradoxes in mathematics and physics and then we will discuss some paradoxes in fluid dynamics such as the « D’Alembert paradox », the reversibility paradox, the Stokes paradox and the Eiffel paradox.
M2	Dr. Adi Nur Cahyono, <i>Learning Math All Around Us in the Digital Age — from Real-World Trails to Immersive Adventures</i>	In the rapidly evolving digital age, the way we learn and engage with mathematics is undergoing a profound transformation. This keynote speech explores how mathematical learning extends beyond traditional classrooms into everyday environments, leveraging the power of both physical and digital spaces. We begin by discussing math trails, where learners engage with mathematics by exploring real-world locations and objects, fostering a sense of discovery and relevance. These trails encourage active problem-solving and collaboration, showing that math is not confined to textbooks but exists around us. As technology advances, digital experiences—such as AR/VR, Robotics, AI, and 3D Printing—offer new opportunities to bring mathematical concepts to life. These tools create engaging, interactive environments where learners can manipulate and visualize abstract ideas, deepening their understanding in ways previously unimaginable. The keynote highlights the integration of mobile apps, simulations, and gamified platforms that make math both accessible and enjoyable. Through case studies and practical examples, we will examine how these innovative approaches—from physical math trails to immersive digital environments—reshape math education’s future. We also address the challenges and opportunities in ensuring these tools are inclusive, promoting equitable access to mathematical learning for all. This keynote invites educators, researchers, and technologists to reimagine how we can harness the world around us and digital advancements to inspire a new generation of confident, curious, and capable mathematical thinkers.
T1	Prof. Mohamed Majdoub, <i>Convexity and Applications</i>	The theory of convex functions is an interesting component of the broader field of convexity. As a convex function is defined by having a convex epigraph. However, it stands out as a theory of significant intrinsic value, permeating nearly all realms of mathematics. Graphical analysis often serves as the entry point into this theory, where we encounter essential concepts like the second derivative test of convexity, a formidable tool for identifying convexity. We provide a comprehensive overview of the subject, emphasizing practical applications and illustrative examples.

T2	<p>Dr. Iyadh Ayari,</p> <p><i>A best proximity point theorem for C-class-proximal non-self-mappings and applications to an integrodifferential system of equations</i></p>	<p>In this paper, we propose a best proximity point theorem for a novel class of non-self-mappings by using the definition of a pair (F, h) of upper class of type II and the concept of C-class functions. Several consequences (including the case of self-mappings) of our obtained results are suggested. We support our obtained results by concrete examples. In the end, we consider an integro-differential system of equations. We ensure the existence of an optimal solution, which turns to be an exact solution of the system when boundary conditions are equal.</p>
T3	<p>Dr. Raed Marabeh</p> <p><i>Performance Comparison of Variable-Stepsize IMEX SBDF Methods on Advection-Diffusion-Reaction Models.</i></p>	<p>Advection-diffusion-reaction (ADR) models, commonly formulated as partial differential equations, are spatially discretized into ordinary differential equations (ODEs) for time-dependent numerical solutions. This talk examines the performance of variable-stepsize, semi-implicit, backward differentiation formula (VSSBDF) methods up to fourth order for ADR models, focusing on two implicit-explicit (IMEX) splitting approaches: physics-based and Jacobian-based. A key contribution is an adaptive time-stepping algorithm based on step-doubling and local truncation error estimates, which dynamically adjusts the timestep for optimal efficiency and accuracy. Performance is evaluated through CPU time and accuracy comparisons, demonstrating the advantages of adaptive time-stepping in high-order VSSBDF methods.</p>
T4	<p>Prof. Ryad Ghanam</p> <p><i>The origin of Lie symmetry methods for differential equations and the rise of abstract Lie algebras.</i></p>	<p>In this talk we shall focus on the origins of Lie theory and discuss several examples of differential equations to which the Lie symmetry method is applicable. Thereafter we shall trace the development of the theory of abstract Lie algebras and its importance in theoretical physics. We will also consider a special system of differential equations on Lie groups; called the geodesic equations of the canonical connection.</p>
T5	<p>Sarii Baathi</p> <p><i>Emotional intelligence skills in math lessons</i></p> <p>مهارات الذكاء الإنفعالي في دروس الرياضيات</p>	<p>تهدف المحاضرة إلى تحديد مهارات الذكاء الإنفعالي وتحديد مقاييسه. وسيتعرف المتدربون على برنامج كفو لتنمية مهارات الذكاء الانفعالي صفوفهم وكيفية تطبيق تدخلات هذا البرنامج على أمثله من حصص الرياضيات</p>
T6	<p>Hiba Jadaan</p> <p><i>Principles of creative solution theory to enhance math practices</i></p> <p>مبادئ نظرية الحل الابتكاري لتعزيز ممارسات الرياضيات</p>	<p>تهدف المحاضرة تحديد مبادئ نظرية الحل الابتكاري والتعرف على المبادئ المناسبة لمادة الرياضيات، وربطها مع المعايير المناسبة (mps)</p>

<p>T7</p>	<p>Dr. Ilyasse Aksikas <i>Optimal adaptive control for a plug flow reactor by integral reinforcement learning</i></p>	<p>This work delves into optimal adaptive control for a plug flow reactor (PFR) partial differential equations (PDEs) model using the integral reinforcement learning (IRL) technique. Initially, it introduces a policy iterative algorithm designed to learn the solution of the corresponding matrix Riccati differential equation in real time. Notably, this method operates independently of explicit insight into the internal dynamics of the PFR process. Moreover, this paper establishes the convergence of the algorithm, contingent upon the initial action being stabilizing. Furthermore, an alternative algorithm is introduced to enhance the practical implementation of the IRL approach. Numerical simulations are performed to the efficacy of the developed algorithm.</p>
<p>T8</p>	<p>Lubna Rawashdeh <i>Developing habits of mind and their role in math</i> ورشة تطوير عادات العقل ودورها في الرياضيات</p>	<p>تهدف المحاضرة إلى التعرف على عادات العقل ال 16 وأهميتها وطرق تنميتها، وتقديم ممارسات وأنشطة لتنمية عادات العقل ال 16 في الرياضيات</p>
<p>T9</p>	<p>Dr. Mohamed Abdalla Abdelslam Mabrok <i>Mathematics and AI in Healthcare: Advancing Stroke diagnosis through Precise Segmentation Techniques</i></p>	<p>Artificial Intelligence (AI) is revolutionizing stroke care by enabling rapid and accurate analysis of medical images, with mathematical methods playing a foundational role in these advancements. This talk will delve into how mathematics intersects with AI to enhance stroke segmentation—an essential process in identifying affected brain regions for timely intervention. Utilizing techniques such as partial differential equations, optimization algorithms, and deep learning models, AI can achieve precise delineation of stroke lesions from complex imaging data like MRI and CT scans. The discussion will emphasize the mathematical principles behind these segmentation algorithms, including methods for handling noise, enhancing image resolution, and ensuring model robustness. Real-world applications, including collaborative research with Hamad Medical Corporation (HMC), will illustrate how these AI-driven approaches are being applied in clinical settings to support radiologists, reduce diagnosis time, and improve patient outcomes. This presentation aims to bridge the gap between theoretical mathematics and its transformative applications in stroke care, showcasing the potential of AI to enhance clinical decision-making.</p>
<p>T10</p>	<p>Dr. Khaled Chbichib, <i>Spectral properties of the Cauchy transform on modified Bergman</i></p>	<p>In this paper, we determine the singular values of the operators CP and PCP where C is the integral Cauchy transform and P is the orthogonal projection from $L^2(D, \mu_{\alpha, \beta})$ onto the modified Bergman space $A^2(D, \mu_{\alpha, \beta})$</p>

<p>T11</p>	<p>Samer Dweik</p> <p><i>Regularity of the transport density in the import/export transport problem</i></p>	<p>In this talk, we analyze a mass transportation problem in a bounded domain with the possibility to transport mass to/from the boundary, paying the transport cost, that is given by a Riemannian distance plus an extra tax depending on the exit/entrance point. This problem appears in import/export model, as well as in some shape optimization problems. First, we provide the relevant duality arguments to connect the corresponding Beckmann and Kantorovich problems to a formulation with Kantorovich potentials with Dirichlet boundary conditions. Then, we study the summability of the transport density which does not follow from standard theorems, as the target measures are not absolutely continuous with respect to the Lebesgue measure but they have some parts which are concentrated on the boundary. Moreover, we prove BV regularity on this transport density but in two dimensions under certain conditions on the domain, the boundary tax and the mass distribution. Finally, we provide a counter-example to a conjecture by G. Buttazzo about the Sobolev regularity of this transport density.</p>
<p>T12</p>	<p>Dr. Samir Belhaouari</p> <p><i>Leveraging Mathematics to Address AI and Security Challenges</i></p>	<p>Solving complex computer science problems becomes more manageable by harnessing the power of unsolved mathematical puzzles and inspiration from nature. Mathematics provides the foundation for crafting advanced algorithms in optimization, hashing, data compression, and model refinement, which are essential for tackling a wide range of challenges in artificial intelligence (AI) and cybersecurity. This talk will explore several key projects that illustrate the pivotal role of mathematics in addressing these issues. Highlights include smart pruning techniques for deep neural networks (Green LLMs, CNNs, etc.), the Walking Algorithm for Longitudinal Key Signatures (WALKS), and optimizing dimensionality reduction and visualization using enhanced clustering and optimal transport. We will also discuss a novel time-frequency decomposition, KNNOR—a method for oversampling and downsampling imbalanced datasets—and chaos-based hashing combined with Gaussian Kernel LSH for improved data security and similarity search. Other topics include feature selection for high-dimensional data, extending the Komlós Conjecture for categorical variable encoding, and various deep learning innovations, such as architectural designs, fine-tuning methods, specialized loss functions, and activation functions. Additionally, we'll cover anomaly detection, clustering techniques, and a dynamic Markov Chain coupled with reinforcement learning for optimization and feature selection. Applications of these techniques in biomedical and bioinformatics domains will be examined, along with the use of number theory in security, particularly in hashing and RSA encryption. Through these projects, we demonstrate how mathematical insights lead to cutting-edge solutions in AI and cybersecurity.</p>

<p>W1</p>	<p>Dr. Khaled Moqdad <i>Effective Classroom Dialogue - The Art of Engaging Students in Math Learning</i> الحوار الصفي الفعال - فن إدماج الطلبة في تعلم الرياضيات</p>	<p>تقدم الورشة أنشطة غير تقليدية لبدء الدرس تثير حواراً صفيّاً فعالاً في الغرفة الصفية يراجع من خلالها المعلم العديد من المفاهيم التي يتعلمها الطالب أو سبق له تعلمها من خلال أنشطة متنوعة جاذبة ومحفزة للتفكير.</p>
<p>W2</p>	<p>Dr. Fatma Al-Hassan, <i>أساليب تفاعلية لتطوير مهارات الطلبة في ممارسات الرياضيات</i></p>	<p>تهدف الورشة التدريبية إلى استثمار خبرات الطلبة اليومية في تعزيز مهاراتهم في ممارسات الرياضيات. سيتم استعراض مجموعة من الأساليب التطبيقية لتفعيل المناقشة الصفية وحل المشكلات، مع التركيز على أفضل الطرق لتحفيز الطلبة على التفكير الناقد والمشاركة التفاعلية في حل التحديات الرياضية. الفئة المستهدفة: معلمات المرحلة الابتدائية</p>
<p>W3</p>	<p>Dr. Ans Abu Joudah, <i>Artificial Intelligence in Math</i> تطبيقات وبرامج الذكاء الاصطناعي في تعليم الرياضيات</p>	<p>تعتبر تطبيقات وبرامج الذكاء الاصطناعي في تعليم الرياضيات أدوات قوية وفعالة تساعد الطلاب على تحسين فهمهم للمفاهيم الرياضية وتعزيز تجربتهم التعليمية. بفضل القدرة على تحليل بيانات الطلاب وتقديم تجربة تعليمية شخصية فريدة، يمكن لبرامج الذكاء الاصطناعي أن تساعد الطلاب في تحقيق تقدم أفضل في تعلم الرياضيات. يتزايد استخدام هذه البرامج في المدارس والمراكز التعليمية حول العالم، ومن المتوقع أن يستمر تأثيرها الإيجابي على تعليم الرياضيات في المستقبل.</p> <p>تركز الورشة التدريبية على استخدام تكنولوجيا الذكاء الاصطناعي في التدريس مما تسهم في تبسيط وتيسير الشرح وتوضيح الدروس والتحضير لها بوقت أقل وجهد أقل وكيفية جعل الذكاء الاصطناعي أداة لإعداد الأسئلة بإجاباتها وكيف نجعل تطبيقات الذكاء الاصطناعي تساعدك في شرح الدروس وتوضيح النقاط ومعالجة فروقات التعلم بين الطلاب</p>
<p>W4</p>	<p>Loai Jebiril, <i>Binomial Theorem for Matrices</i></p>	<p>نظرية ذات الحدين (Binomial Theorem) هي واحدة من الأدوات الرياضية الأساسية في التحليل الرياضي والجبر. ، واستخداماتها تمتد إلى العديد من المجالات التي تشمل المصفوفات، خاصة في تحليل الأنظمة المتكررة والمتسلسلات سنتعرف من خلال هذه الورشة إلى بعض العلاقات غير المباشرة التي يمكن الحديث عنها مثل تحليل متسلسلات القوى (Power Series Expansion) و الأسس والمصفوفات (Matrix Exponentiation)</p>
<p>W5</p>	<p>Prof. Abdelouahed Hamdi, <i>Creative Solutions: Employing Inequalities in Math Education</i></p>	<p>In this workshop, we will explore some fundamental classical inequalities and inspire both teachers and students to appreciate their various applications in deriving elegant results across Calculus, Geometry, and Algebra. Our objectives include:</p> <ul style="list-style-type: none"> ▪ Presenting captivating results from key topics commonly taught in mathematics. ▪ Revisiting "Basic Mathematical Tools" to effectively address complex challenges. ▪ Enhancing our perspectives on so-called "hard problems." ▪ Participants will be encouraged to engage actively and share their insights on tackling the questions presented.

<p>W6</p>	<p>Dr Adi Nur Cohyeno, <i>Math Trails with Digital Technology</i></p>	<p>The workshop will provide an overview of the fundamental principles of mathematical trails, focusing on designing mathematical modelling tasks for these trails. Furthermore, the practical aspects of creating and simulating mathematical trails using digital technology will be explored. The workshop will utilize the following digital technologies: MathCityMap, GeoGebra, STEM Trails and Virtual Reality. The design of mathematical trails can be undertaken in various settings, including campuses, city parks, landmarks, tourist attractions, and virtual environments. The expected outcome of this workshop is that participants will be able to design mathematical trails for use in educational settings, as well as for leisure activities and mathematical competitions.</p>
<p>W7</p>	<p>Prof. Mohamed Majdoub, <i>تحديات تدريس الرياضيات</i></p>	<p>تدريس الرياضيات يُعدّ تحديًا كبيرًا للمعلمين على جميع مستويات التعليم. في هذه الورشة، سنسلط الضوء على أبرز الصعوبات والتحديات التي قد تعترضهم، مع تقديم أمثلة عملية توضح ذلك. بالإضافة إلى ذلك، سنقدم مقترحات تهدف إلى حل بعض المشاكل التي ترتبط بتدريس الرياضيات. وفي نهاية الورشة، سيتم فتح باب النقاش للاستماع إلى تجارب بعض المعلمين والتفاعل معها، ومن ثم سيتم صياغة ملخصات وتوصيات قابلة للاستفادة العملية.</p>
<p>W8</p>	<p>Dr. Houssam Kasti, <i>Spotting the error as a strategy to overcome students' mistakes in algebra</i></p>	<p>When working on algebra, students often repeat their errors. Sometimes, these errors are simply "slips of the pen" caused by a momentary lapse in concentration. Other times, they stem from serious underlying issues. Regardless of the cause, errors frustrate students as well as their teachers. Additionally, errors can affect students' self-confidence, leading them to think, "Despite all my practice, I still can't do this!" Teachers also find it frustrating to see these errors appear continuously despite their careful explanations, numerous examples, various teaching methods, and extensive practice in class.</p> <p>In this workshop, we will introduce a new, under study, strategy to overcome the problem of error repetition by students in their algebra. Attendees will be introduced to the idea with hands on activities that might be used in their classrooms and might be generalized to other mathematics sub-subjects.</p>
<p>W9</p>	<p>Tasneem Ayash, <i>مدخل VRA في تدريس الرياضيات</i></p>	<p>تهدف المحاضرة إلى التعرف على استراتيجيات تربوية حديثة ضمن مدخل VRA لرفع تحصيل الطلبة منخفضي الأداء الأكاديمي في الرياضيات، وتطوير قدرة المعلم على توظيف أي برمجة للرياضيات ضمن تسلسل تدريسي وإطار تربوي مُعتمد وقائم على الأدلة باستخدام استراتيجيات تربوية حديثة مواكبة لثورة التقنيات والتكنولوجيا.</p>

شكرًا لحضوركم يوم قطر للرياضيات الرابع. ونأمل أن تكونوا قد وجدتم هذا الحدث مفيدًا وجذابًا. لمساعدتنا في تحسين الأحداث المستقبلية، نرجو منك تقديم ملاحظاتك. يرجى مسح رمز الاستجابة السريعة ضوئيًا للوصول إلى نموذج التعليقات الخاص بنا. إن أفكارك لا تقدر بثمن بالنسبة لنا وستساعدنا على تحسين جودة فعالياتنا. شكرًا لك على وقتك والمدخلات.

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Thank you for your time and input.



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