University of Puerto Rico
Mayaguez Campus
Dean of Arts and Sciences

Annual Report 2022-2023

Submitted by:

Dr. Omar Colón Reyes, Director
Department of Mathematical Sciences

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Report of Initiatives, Activities and Achievements according to the Strategic Plan

A. Executive Summary

Department Structure:

- The Department of Mathematical Sciences offers a wide variety of study programs, both at the undergraduate and graduate levels. These programs are:
  Undergraduates: Bachelor's degrees in Pure Mathematics, Computer Science and Mathematics Education.
  Graduates: Master's degrees in Applied Mathematics, Pure Mathematics, Scientific Computing, Mathematical Statistics, and Mathematics Teaching at the Pre-University Level. PhD in Information and Computing Sciences and Engineering (CISE).
- The Department of Mathematical Sciences has a staff of 32 professors in the specialties of Applied Mathematics, Computer Science, Mathematics Education, Pure Mathematics, Scientific Computing and Statistics. It also has 57 graduate students from different countries: Puerto Rico, Colombia, Honduras and the United States.
- Its administrative staff consists of a director, an associate director, an administrative officer, 3 secretaries, a systems coordinator, and a user services technician.

B. MISSION AND VISION

The vision of the Department of Mathematical Sciences is:

- Offer undergraduate and graduate programs of excellence in Mathematics (Pure and Applied), Statistics, Mathematics Education and Computer Science.
- Promote research in the aforementioned areas.
- Promote interdepartmental and interuniversity collaboration projects, both nationally and internationally.
- Promote teacher and student training projects to improve knowledge of mathematical sciences in Puerto Rico.
- Offer service courses to other UPRM academic programs, as well as advice on computing, statistics and mathematics to the community in general.

The vision of the Department of Mathematical Sciences consists of:

- Provide a high-quality education for all students.
- Promote the development of research and the wide dissemination of mathematics, statistics, education, computer science and other related areas.
- Maintain effective links that promote the development of the industry and the community in general.

C. TO INSTITUTIONALIZE A CULTURE OF STRATEGIC PLANNING AND ASSESSMENT

- **DEPARTAMENTAL COLLOQUIUM**
  - Group of conferences in charge of prestigious members of the national and international mathematical community, whose purpose is to promote professional improvement among professors, graduate students, and undergraduate students, as well as to foster inter-university collaboration at all levels.

- **INTER-UNIVERSITY SEMINAR ON MATHEMATICAL RESEARCH-(SIDIM)**
  UPRM representative before the Committee IN CHARGE: Dr. Ángel Cruz.
  Date and place:24 and 25 February 2023, UPRM Business Administration Building
  Description: The SIDIM is an international academic activity where the latest research in Mathematics (Pure Mathematics, Applied Mathematics, Mathematics Education, and Computer Science) are presented. This seminar was established in the UPRM and celebrated its XXXVIII edition. The venue for the following year is selected at the closing meeting of the year of celebration. The seat can be requested by public and private universities in Puerto Rico. The Rudder Committee organizes the activity and selects the plenary speakers. The recurring conferences, as well as the presentation of posters are by registration. Due to the high level of the activity, it is aimed at professors, graduate students, and undergraduate students who are recommended by a member of the department's faculty.

- **Award of the Gauss Medal**
  Annual prize awarded by the department to the best averages in its baccalaureate programs.

- **Precalculus and Calculus skills**
  Professors in charge: Dr. Reyes M. Ortiz and Dr. Pedro Vásquez.
  Place and Date: March 14, 2023.
  Academic activity of public and private school students at the island level, which seeks to promote mathematical culture among future university students.

- **William Lowell Putnam Competitions**
  Professor in charge: Dr. Stanley Dziobiak
  Place and Date: December 7, 2023, UPRM.
  Description: Prestigious competition sponsored by the Mathematical Association of America (MAA) for undergraduate students from the United States and Canada.

- **International Competition COMATEQ 2023**
  Date: Saturday, March 4, 2023
  The UPRM 2023-2299 and UPRM 2023-2321 teams from UPRM obtained second and third place, respectively, in the general competition. The winning teams at the Puerto Rico level obtained: 3 Gold medals (UPRM 2023-2299 team), 2 Silver medals (UPRM 2023-2321 team) and 3 Bronze medals for each of the teams: UPRM 2023-2298, UPRM 2023-2307 and UPRM 2023-2317

PROMOTE RESEARCH AMONG UNDERGRADUATE AND GRADUATE STUDENTS

- ORAL PRESENTATIONS
  - Darío Padró, “Interacting Particle Systems” in “Joint Mathematics Meeting 2023”, 4-7 of January of 2023, Boston Massachusetts.
  - Laura Vargas González, “A multivariate markovian model and the use of bootstrapping to calculate uncertainty”, February 19, 2023, SIDIM 2023 UPRM.
  - Jhonnatan Ortega, “Implementation of guidelines to strengthen previous conceptual weaknesses in students of precalculus I of the UPRM under the modality of corequisite support.”, February 19, 2023, SIDIM 2023 UPRM.
  - Sebastian Alzate, “An augmented multivariate hidden Markov model to capture dynamics in freely diffusing smFRET experiments, February 19, 2023, SIDIM 2023 UPRM.
  - Eduar Castañeda, “Initialization algorithm using distribution-free methods for clustering”, February 19, 2023, SIDIM 2023 UPRM.
  - Geraldo E. Soto Rosa, “Computable finite factorization domains”, February 19, 2023, SIDIM 2023 UPRM.
  - Jason Bermúdez, “A conservative splitting-high order finite difference method for coupled Gross-Pitaevskii equations in 2D”, February 19, 2023, SIDIM 2023 UPRM.
  - Alibeth E. Luna Alvear, “Optimization based analysis of microarray experiments involving CAR T-cells, February 19, 2023, SIDIM 2023 UPRM.
  - Gradmar E. Maldonado Marti, “Actions and factorizations”, February 19, 2023, SIDIM 2023 UPRM.
  - Haider Montes Masmela, “An interactive multicriteria simulation optimization method applied to true experiments, February 19, 2023, SIDIM 2023 UPRM.
  - Diego Rivera Correa, “Constructing 2D watermarks by composition, February 19, 2023, SIDIM 2023 UPRM.
  - Daniel Rocha Clavijo, “Statistical models for calcium signaling in Arabidopsis Plant, February 19, 2023, SIDIM 2023 UPRM.
  - Deiver Suárez Gómez, “Blood gene expression comparison between autism and schizophrenia through biooptimatics February 19, 2023, SIDIM 2023 UPRM.
  - César F. Bolaños Revelo, “Improving correlation properties of 3d periodic arrays constructed from elliptic curves”, February 19, 2023, SIDIM 2023 UPRM.
  - Ferney Henao Ceballos, “Censored Zero-inflated Poisson Regression Models: Predicting Success in Undergraduate Math Courses”, February 19, 2023, SIDIM 2023 UPRM.
  - Kevin Silva Perez, “Diffusion on Bronchial trees I: construction and approximation results”, February 19, 2023, SIDIM 2023 UPRM.
  - Eric J. Pabon Cancel, “Permutation Invariant Parking Assortments”, February 19, 2023, SIDIM 2023 UPRM.
  - Ferney Henao, “How do Mathematics Teachers in Puerto Rico Perceive the Mathematics Competitions?” (with Dr. Luis F. Cáceres), Oral presentation at

INTED2023 (17th annual International Technology, Education and Development Conference), March 6-8, 2023, Valencia, Spain.

- Jonathan Ortega, “Presentation on research carried out by graduate students in the Department of Mathematical Sciences of RUM” (with Dr. Luis F. Cáceres), University of Nariño, Pasto-Colombia, January 12-17 2023.
- Jonathan Ortega, ““Presentation on research carried out by graduate students in the Department of Mathematical Sciences of RUM” (with Dr. Luis F. Cáceres), University of Valley, Cali-Colombia, January 12-17, 2023.
- Jonathan Ortega, “Conceptual Weaknesses Found in New Students of Precalculus I At The University Of Puerto Rico, Mayaguez Campus” (with Dr. Luis F. Cáceres), Oral presentation at INTED2023 (17th annual International Technology, Education and Development Conference), May 6-8, Valencia, Spain.
- Michael J. Rivera Serrano., Conference: NAPhCxii 2023, held in Concordia University, Montreal, Canadá, May 11-15, 2023.
- Kevin Silva Pérez, “Diffusion over ramified domains: Solvability and Regularity”, June 2023, University of North Carolina at Wilmington.

D. TO LEAD HIGHER EDUCATION THROUGHOUT PUERTO RICO WHILE GUARANTEEING THE BEST EDUCATION FOR OUR STUDENTS

The best education is measured through the quality of our faculty, experiences outside of the classroom, or research projects.

E. TO INCREASE AND DIVERSIFY THE INSTITUTION’S SOURCES OF REVENUE

The Department of Mathematical Sciences continues to seek external funds to complement the budget that is granted annually. The participation of our faculty in short, medium, and long-term initiatives is indicative of our commitment to academic, research, and administrative excellence.

• Writing, revision and marketing of the books that are under our department and that are used for the basic courses. The faculty of our department are recognized nationally and internationally for their achievements and contributions in academia and research. Given this experience and the constant increase in the cost of student books, our department took the initiative to write the following books: Text and Exercise Manual for MATE 3171 (Pre-calculus I), Text and Exercise Manual for MATE 3172 (Pre-calculus II), Text of MATE 3086 (Mathematical Reasoning). This initiative, in addition to lowering the cost of textbooks, provides income to the department to be used in initiatives with a direct impact on students, academia, and research.

• Mathematical Strengthening Institute (INFOMATE), which is generating income because students have recognized its importance in reviewing the topics required to pass the Mathematics Diagnostic Exam.

All these revenues are being used to pay for services that impact teaching, research, and the administrative processes that support these services.

E. TO IMPLEMENT EFFICIENT AND EXPEDIENT ADMINISTRATIVE PROCEDURES

- Initiatives continue to be implemented to achieve greater efficiency and agility in administrative processes that contribute to the "no-paper" policy: digitization of files, increasing the efficiency of the digitized process of approval certifications for the Mathematics Diagnostic Exam and of the Institute of Mathematical Strengthening.
- Renewal of the department's page, making it more agile, fast, efficient and friendly: http://math.uprm.edu.
- Improvement of the servers and update of the files to continue offering the Institute of Mathematical Strengthening (INFOMATE) completely online. This initiative has had a great impact, because it allows users to connect, regardless of the geographical location where they are. INFOMATE serves as a support for all UPRM students, as well as for anyone who wants to review the content of the topics prior to precalculus.
- Improvement of the servers and update of the files to continue offering the Mathematics Diagnostic Exam online, to increase its accessibility to all those new students who obtain 604 or less in the PAA exam of the College Board.
- Use of the Sign Request platform for the agile and efficient processing of administrative and student documents that require signatures from different departments and Deans.
- It continues to encourage obtaining the Online Teaching Certification offered by DECEP for all professors and teaching assistants in the department. In this way, the resource of distance learning is maintained as an educational alternative and as a tool to obtain external funds.

F. TO STRENGTHEN RESEARCH AND COMPETITIVE CREATIVE ENDEAVORS

In addition to teaching, the UPRM has the obligation to contribute with new knowledge, that is, to sponsor research on original problems and encourage publications. Our work is manifested through the graduate program and its theses, as well as in the undergraduate program.

APPROVED PROPOSALS:

- *Dr. Luis F. Cáceres Duque-2022*-PROTaSM (Puerto Rico Opportunities for Mathematics Talented Students) 2022, Epsilon Fund, American Mathematical Society, ($4000) PI.
- *Dr. Luis F. Cáceres Duque-2022*-Strengthening of math skills for new UPRM students in 2022: DREAMS, Corequisite Support and Math Tutorial Center “CRRSAA, summer 2022 $50,000, PI
- *Dr. Luis F. Cáceres Duque-2022*-Strengthening of math skills for new UPRM students in 2022: Corequisite Support and Math Tutorial Center “CRRSAA, 2022 $60,000, PI

- *Dr. Luis F. Cáceres Duque*-2023-OMPR (Puerto Rico Math Olympiads). MAA Dolciani Mathematics Enrichment Grant, ($5000), PI
- *Dr. Luis F. Cáceres Duque, Dr. Omar Colón Reyes- 2023* Strengthening of math skills for new UPRM students in 2023: DREAMS, Corequisite Support and Math Tutorial Center "CRRSAA, summer 2023 $75,000

APPROVED PROPOSALS:

- AKSF & Math Kangaroo. The world's largest international mathematics competition with Meike Akveld, Notices of the AMS, Vol 69, Nr. 11, pp 1956-1960, December 2022.
- The impact of mathematics competitions on teachers and their classrooms in Puerto Rico, Switzerland and UK: A comparative study with Meike Akveld, Ferney Henao and David Crawford, ZDM, Springer, Vol 54, Nr. 5 pp. 941-959, 2022.
- Comparison of two algorithms to solve the ideal membership problem in Z[x] with Silvia López, Espacio Matemático, Vol 2, Nr. 2, 2022.
- Conceptual weaknesses found in Precalculus I students at UPRM with Jhonnatan Ortega, Mathematical Space, Vol 2, Nr. 2, 2022.
- **"**Finding Solutions to the Yang- Baxter-like Matrix Equation for Diagonalizable Coefficient Matrix, link: https://www.mdpi.com/2073-8994/14/8/1577 2022, (14, 1577); pp 1-6.
- "A new family of 3D Watermarks", was accepted for publication in ACM SE '22 Proceedings, April 2022, pp. 254-256
- Article: "Mathematics Olympiads curriculum for Primary School in Ibero-America" For publication at the Journal de la World Federation of National Mathematics Competitions (WFNMC).

CONFERENCES, WORKSHOPS, TALKS OR POSTERS PRESENTED BY GRADUATE OR UNDERGRADUATE STUDENTS SUPERVISED BY PROFESSORS

Student: Cesar Bolaños- Mentor: Dr. Dorothy Bollman-Virtual presentation- "A new family of 3D Watermarks". Southeastern ACM Conference April 18-20,2022.

Student: Axi Aguilera- Mentor: Dr. Paul Castillo
Conservative High Order Finite Difference Method for Schrodinger Nonlinear Systems, Universidad Autónoma de Tlaxcala Mexico, September 28, 2022. Award Winner of the Graduate Level Poster Session at IPAM Latinx in the Math Sciences, Conference 2022, July 7-9 2022

Student: Gradmar Maldonado Mentor: Dr. Reyes M. Ortiz Albino
Title: Actions and Factorizations, MATH FEST 2022, Philadelphia, PA Date: August 3-7, 2022
Title: Actions on Relations GCURS 2022, Rice University, TX date: October 8-9,2022
Title: Actions on Relations: SIDIM 2023, UPR-Mayagüez, PR date: February 23-24, 2023

Title: Actions on Relations II: JTM/PRISM 2023, UPR-Bayamón, PR date: April 29,2023.

Student: Darío Cruzado Mentor: Dr. Reyes M. Ortiz Albino
Title: Some results of k-almost τn-primes GCURS 2022, Rice University, TX date: October 8-9, 2022
Title: On τn-semiprimes and asymptotic behavior JTM/PRISM 2023, UPR-Bayamón, PR date: April 29,2023

Student: Eric Pabón Cancel Mentor: Dr. Reyes M. Ortiz Albino
title: Distribution of τn-primes. Student name: Eric Pabón Cancel Place: GCURS 2022, Rice University, TX, date: October 8-9, 2022
Title: Study of τn-primes, SACNAS 2022, San Juan, PR date: October 22-26,2022 Title: Distribution of τn-primes JTM/PRISM 2023, UPR-Bayamón, PR date: April 29,2023

Student: Jhonnatan Ortega Mentor: Dr. Luis Cáceres Duque
Alliance activities between the Universities of Colombia: University of Lariño and Universidad del Valle with the University of Puerto Rico-Mayagüez Campus

Date: Friday, January 13, 2023, Place: University of Nariño, Pasto, Colombia
Topic: Work meeting with Dr. Catalina Rua and professors from the department of the University of Nariño.
Date: Monday, January 16, 2023, Place: University of Nariño
Theme: Research presentation: Luis Cáceres and Jhonnatan Ortega, meeting with undergraduate students for orientation of the UPR-M graduate mathematics program
Date: Wednesday, January 18, 2023, Place: Universidad del Valle, Cali, Colombia
Theme: Presentation of research: Luis Cáceres and Jhonnatan Ortega, meeting with undergraduate students for orientation of the UPRM graduate mathematics program, meeting with Dr. Carmen Ramírez, Director of the mathematics major, Dr. Julio Cesar Delgado, Director of the postgraduate from the Department of Mathematics, Dr. Angélica Caicedo from the Mathematical Olympiads of the Universidad del Valle and Dr. Marlio Paredes, professor of the department.

Student: Marina L. Rodríguez González, Mentor: Dr. Israel Almodóvar

Title: “Quantitative Research in Life and Social Sciences Program (QRLSSP), Arizona State University, May 31 to July 21, Collaborators: Arizona State University, Simon A. Levin Mathematical Computational and Modeling Sciences Center, Funds: National Science Foundation (NSF), National Security Agency (NSA), Arizona State University and Office of the Executive Vice-president and Provost of the University.

SUBMITTED PUBLICATIONS:

Dr. Xuerong Yong and Dongmei Chen- *MDPI Journal*2022, (14, 1577); pp 1-6.
Title: “Finding Solutions to the Yang- Baxter-like Matrix Equation for Diagonalizable Coefficient Matrix

***Dr. Paul Castillo,* A. Aguilera, J. Bermudez**- European Journal Plus, November 2022
Title- "A conservative splitting-high order finite difference method for coupled Gross-Pitaevskii equations in 2D".

Dr. Alcibíades Bustillo Zarate- Communication and Computing (AAECC)". December 14, 2022 (2nd revision).
Title: "Using Elliptic Curves to Construct 3D Arrays, Applicable Algebra in Engineering

ACCEPTED FOR PUBLICATION:

Dr. Karen Ríos, Dr. Alejandro Vélez-Title of Proposal: "Boricuas in Applied Mathematics"
Fostering Collaborations in Puerto Rico has been accepted for the 2022 SACNAS National Diversity in STEM (NDISTEM) Conference at the Puerto Rico Convention Center in San Juan, PR-October 27-29, 2022

***Dr. Alejandro Vélez Santiago,* Carlos Carvajal- Arizu, Javier Henríquez- Amador**
Article: "The generalized anisotropic dynamical wentzell heat equation with nonstandard growth conditions" was accepted for publication in: Journal D' Analyse Mathematique (https://www.springer.com/journal/11854)

***Dr. Israel Almodóvar*,** Gabriela Ortiz-Soto, Natalia S. Babilonia-Diaz, Mercedes Y. Lacourt Ventura, Delmarie M. Rivera-Rodríguez, Jailenne I. Quiñones-Rodríguez, Mónica Colón-Vargas, Israel Almodóvar-Rivera, Luis E. Ferrer-Torres, Ivette J. Suarez-Arroyo, Michelle M. Martínez-Montemayor.
Article: Metadherin regulates Inflammatory Breast Cancer Invasion and Metastasis, was accepted for publication in: International Journal of Molecular Sciences.

Dr. Luis Cáceres, Dr. Omar Colón, Dr. Alejandro Vélez, Dr. Arturo Portnoy, Darwin Gutiérrez, Edwin Flórez, Ferney Henao, Silvia López, Julián Jiménez, Jhonnatan Ortega and Juan Flórez. "Problems and Solutions: Mathematics Olympiads in Puerto Rico: 2021-2022, OMPR publications, 2023.

Dr. Luis Cáceres, Ariana Rodríguez and Lizbeth Alvarado. "Mathematics Olympiads Curriculum for Primary School in Ibero-America. Accepted, 2023.

RESEARCH:

Dr. Alcibíades Bustillo Zarate-Subgraduate Investigation- "Constructing 2D Watermarks by Composition". October 2022- December 2022 CASH SI LREU Program

Dr. Israel A. Almodóvar Rivera-Theme: Contributions to Distribution Free Clustering Methods
Name of project: Estimating the number of groups using distribution free methods
Agency submitted: National Sciences Foundation (LEAPS)

Dr. Reyes Ortiz- Title: Actions and factorizations II, August 2022-May 2023 Source of Funds: National Science Foundation - HRD 2008186

Dr. Reyes Ortiz- Title: Distribution on τn-primes, August 2022-May 2023 Source of Funds: National Science Foundation - HRD 2008186

Dr. Reyes Ortiz- Title: On τn-semiprimes and asymptotic behavior, August 2022-May 2023 Source of Funds: National Science Foundation - HRD 2008186

ACTIVITIES:

• **DREAMS Camp (Discovering RUM Experiences in Applied Mathematics)-** Virtual camp aimed at all new 2022-2023 students in which they had the great opportunity to have their first university summer experience and better prepare for their mathematics courses at the school. It was held on July 25 to 29, 2022 from 8:00 a.m. to 11:30 a.m. / 1:00 p.m. to 4:30 p.m.
Program directors: Dr. Omar Colón and Dr. Luis F. Cáceres.

• **Welcome Activity for Newly Enrolled Undergraduate Students**
First Academic Year 2022-2023- Activity held on Friday, August 5 from 9:00 am onwards in the F-B Physics amphitheater
Guests: Newly admitted undergraduate students and department professors

• **Welcome Activity for newly admitted Graduate Students**, in the following programs: Applied Mathematics: **4**, Scientific Computing: **3**, Mathematics Education**: 3** and Statistics: **2** for a total of **12** students, it was carried out on August 26, 2022, from 5:00 pm onwards in the El Mezzanine room. Guests: Graduate students of the department (42) and professors of the department (33).
Coordinator: Dr. Luis F. Cáceres.

• **Prepa Week** dedicated to new students 2022-2023- August 2 to August 6, 2022.

• **INFOMATE**- October 22 to December 6, 2022
3 online sections:
1: October 24 to December 5
2: October 20 to December 6
3: October 22 to December 3

• **Open House Activity** for students interested in doing Graduate Studies in the Department of Mathematical Sciences held on: Thursday, November 10, 2022 in the squares in front of the Chardón Building, at 7:30 am and ending at 12:00 noon.
Professors: Dr. Omar Colón, Dr. Flor Narciso, Dr. Víctor Ocasio, Dr. Reyes Ortiz, Dr. Pedro Vázquez, Dr. Edwin Flórez and Dr. Alcibíades Bustillo
Graduate students who collaborated: Clara Blanco, Sandra Castro, Silvia López, Sebastián Jansasoy, Kevin Silva, Francisco de Jesús, Laura Vargas, Jimmy Carrero, Gradmar Maldonado and Eric Pabón.

• **Online open house**.

• **International Dinner** held on Saturday, November 19, 2022 at 6:00 pm at El Mezzanine room. This activity has the purpose of merging and tasting the typical dishes belonging to the countries of origin of the graduate students, teaching and non-teaching staff of the Department of Mathematical Sciences. Professors, graduate students, Deans of Arts and Sciences (Dr. Fernando Gilbes, Dr. Hernán Santos, Dr. Matías Cafaro and Dra. Nancy V. Vicente) and department staff were invited.
• A gift was delivered for the achievement of the Gauss Medal to the student Ricardo A. Quiñones with a concentration in Pure Mathematics. The student went in person on Wednesday, November 30, 2022 to pick up an Apple Ipad Mini with a dedication plaque.

• **Mathematics Diagnostic Exam**- Thursday, December 8, 2022. Modality: Online Registration address: http://pegasus.uprm.edu/registro.

• **Initiation of PythagonRUM** from the Department of Mathematical Sciences
Date: Friday, December 9, 2022 in the El Mezzanine room, Hours: 6:00 p.m.
Counselors: Dr. Víctor Ocasio and Dr. Reyes Ortiz
Members: Gradmar Maldonado-President, Eric Pabón- Vice President, Arnaldo R. Carrasquillo- Treasurer, Diego Cintrón- Member, Diego López Ramos, Beverly Jane Malugin-Ayala, Alexander Torres González, Viviana A. Cáceres Barbosa, Armando A. Aguila Otero, Yamian J. Navarro Laureano, Darío Cruzado Padró, Michael Rivera Serrano, Reynaldo J. Falcon Torres, Bryan Busby, Carlos A. Rivera Pacheco, Arnaldo Vera, Nicolas Vázquez, Cesar A. Ruiz, Yan Aquino, José González, Jean Carlos Maldonado Cortes , Marco Yu Cordero, Marina Rodríguez, Santino Kaplan, Mario Escabi. Guests: Dr. Omar Colón, Dr. Flor Narciso, Dr. Nancy V. Vicente and professors from the department.

• **How to bring students closer to mathematics, College Board, Puerto Rico** (Virtual)
Dr. Luis F. Cáceres- over 500 participants

• Convention number 30 of the Association "**Kangaroo without Frontiers**"
Dr. Luis F. Cáceres, Cervia, Italy, 2022

• **COME 2022 (Virtual) Honduras**- A tour of some strategies for teaching and learning mathematics. Over 500 participants. Dr. Luis F. Cáceres

• **Research and Academic Development Windows**, Cartago, Costa Rica 2022, Dr. Luis F. Cáceres

• Meeting Board of the **AKSF**, Istanbul, Turkey 2022, Dr. Luis F. Cáceres

• **CMCK Workshop**, Alberta, Canada 2022, Dr. Luis F. Cáceres

• **Faculty and Graduate Students Meeting**- fraternization activity
Date: Friday, February 10, 2023, Location: Student Center, annex 2nd floor, Tarzan room. Time: 5:00 pm- 9:00 pm. Participation: Dr. Fernando Gilbes Santaella, Dean of Arts and Sciences, Dr. Omar Colón- Director of Mathematics, Dr. Luis Cáceres Duque- Graduate Coordinator Presentations by: Dr. Alejandro Vélez, Dr. Karen Ríos, Dr. Luis Cáceres, Dr. Alcibíades Bustillo and Dr. Roberto Rivera

• **Great Simulation of the First Exam of Precalculus I and Precalculus II**- free simulation that includes presentation of the corrected exam and key for the student to experience what their first exam will be like.
Date: February 16, 2023- Precalculus I
Date: February 14, 2023- Precalculus II
Hours: 10:30 a.m.- 12:00 p.m.
Location: Physics Amphitheatres- FA, FB and FC

• **XXXVIII SIDIM**- Interuniversity Seminar on Research in Mathematical Sciences
Date: Friday, February 24 to Saturday, February 25, 2023
Location: Business Administration Building- RUM
Participation: 250 participants.
Leading-edge world-caliber guest speakers on the latest research in the field of mathematics:

Dr. Irena Swanson- Purdue University, West Lafayette, Indianapolis
Research Interest: Commutative Algebra
Dr. Ayman Badawi- AUS (American University of Sharjah), Dubai
Research Interest: Commutative Algebra
Dr. Felix Gotti- MIT (Massachusetts Institute of Technology) Cambridge, Massachusetts, Research Interest: Algebra, Combinatorics and Geometry

• **COMATEQ 2023** Team Mathematics Competition, Saturday, March 4, 2023

• **Open House Activity**
Date: March 14, 2023, Hours: 9:30 am- 12:30 pm
Activity aimed at students from tenth to twelfth grade interested in studying: Mathematics Education, Pure Mathematics and Computer Science.
Professors: Dr. Omar Colón, Dr. Pedro Vásquez

• **XXII Calculus Competition**- Competition open to all students of the school, and to groups from different universities and colleges. The first ten (10) positions in each of the competitions are awarded and the first three (3) places in each competition are highlighted. Coordinators: Dr. Reyes Ortiz, Dr. Pedro Vásquez, Dr. Wieslaw Dziobiak, Dr. Freddie Santiago, Date: March 14, 2023, Time: 10:30 am- 12:00 noon
Location: Physics Amphitheaters- FA, FB and FC

• **Graduate Studies Fair**- activity in which graduate students from the mathematics department participate to promote the programs offered at the master's level and curricular sequences; as well as the opportunity to present their research papers.
Date: Friday, March 17, 2023, Place: Student Center, Time: 9:00 am- 2:00 pm

• **INFOMATE**- March 18 to May 4, 2023
3 online sections:
1: March 27 to May 3
2: March 23 to May 4
3: March 18 to April 29

• **Math League Competition**
Location: Robinson College, Isla Verde
Date: Thursday, March 23, 2023 8:00 am- 2:00 pm
Participating graduate students: Silvia López, Ariana Rodríguez, Ferney Henao, Jhonathan Ortega, Junior Arauz, Lizbeth Alvarado and Patrick González.
Professors: Dr. Omar Colón Reyes and Dr. Luis Cáceres Duque

• **Honor Roll 2021-2022**- Activity carried out to recognize outstanding students in the mathematics department.
Date: Friday, April 14, 2023
Place: Tarzan Room, Floor 2, Cafeteria Annex, Time: 5:00 pm- 9:00 pm

• **Gauss Medal**- Second Academic Semester 2022-2023
Pure Mathematics- Pedro Felipe González Medina
Computer Science- Diego Luis Rivera Correa

• **Third phase of the Puerto Rico Olympics of the 22-23 cycle of OMPR 2022-2023 Olympic Cycle Awards Ceremony**
Date: Saturday, April 15, 2023
Venue: Rafael Mangual Coliseum

• **First Phase of the Puerto Rico Mathematical Olympics Cycle 2023-2024 OMPR**
Date: April 17 to May 15, 2023

• **Fourth phase of the Puerto Rico Olympics of the OMPR Cycle 22-23**
Intermediate Level and Higher-Level students selected from the third phase.
Date: April 29 and 30, 2023

• **Mathematics Diagnostic Exam**- Saturday, May 6, 2023. Modality: Online
registration address: http://pegasus.uprm.edu/registro

• **International Olympics 2023**
Center 2023- El Salvador
Ibero 2023- Brazil
IMO 2023- Japan

• **Meeting between Faculty and New Students 2023-2024**
Saturday, May 6, 2023- time: 9:30 am- 3:30 pm
Business Building: AE-242 and AE-244
Coordinator: Dr. Pedro Vásquez

• **Diagnostic Exam** for new students- Saturday, May 6, 2023 (online) and from May 18 to 20, 2023.

• **INFOMATE**- New students 23-24
2 online sections:
1: June 1 to June 9, 2023
2: June 20-28, 2023

• **23rd OMPR Summer Camp** for Gifted Students
Date: June 22 to 25, 2023
Place: CROEM facilities, Mayagüez, Dr. Luis Cáceres and Dr. Omar Colón

• **Virtual Camp DREAMS**-New Students 2023-2024
Date: June 12 to 16, 2023 (1st section) and June 26 to 30, 2023 (2nd section)
Total participants: 1st section-259, 2nd section- 193
Dr. Luis Cáceres Duque, Dr. Omar Colón Reyes, Dean of Students- Dr. Jonathan Muñoz Barreto

• **Summer camp "Explore your Vocation in the Arts and Sciences**"
Date: June 13 to 17, 2023
Location: RUM- Biology Building (lobby) and Figueroa Chapel Amphitheater
Participants: Dr. Pedro Vásquez Urbano, Dr. Uroyoán Walker, Dr. Edwin Flórez, graduate student: Luz Adriana Gaitán Veloza

COLLOQUIUM

• Virtual- Dr. Maurice Rojas, Texas A & M University
Title: Counting Real Roots of "Fewnomials"
November 10-2022, 10:30 am, link: meet.google.com/urm-rhmx-dhw

• In person- Dr. Luis Medina, UPR Río Piedras
Title: A Characterization of k-rotations Boolean functions
November 17-2022, 10:30 am, Physics Amphitheater B

• Onsite- Dr. Deepam Patel, Purdue University
Title: Enriched Hodge Structures
November 22-2022, 10:30 am, Physics Amphitheater B

• Onsite- Dr. Matthew Junge, Baruch College
Title: Ballistic Annihilation
December 6-2022, 10:30 am, Physics Amphitheater B

• Virtual- Dr. Hortensia Soto, Colorado State University
Title: Embodied Cognition: What is it? How does it Involve Mathematics?
December 8-2022, 10:30 am, link: meet.google.com/urm-rhmx-dhw

• Virtual/ Face-to-face- Dr. Felix Gotti, Massachusetts Institute of Technology
Title: Atomicity and the Ascending Chain Condition on Principal Ideas
February 22, 2023, 5:00 pm, Celis-116
link:
https://us02web.zoom.us/j/85295709097?pwd=bUlsc3ZPZUZQa3NMN3VwcTJ5dE01dz09

• Virtual/Onsite- Dr. Irena Swanson, Purdue University
Title: Primary decompositions
February 23, 2023, 10:30 am, Celis-116
link:
https://us02web.zoom.us/j/81148054497?pwd=Qmt6blR1UURGdi9yM3E2YmM0UkxmZz09

• Virtual/ Face-to-face- Dr. Ayman Badawi, American University of Sharjah
Title: Absorbing Ideals in Commutative Rings: A Survey
February 24, 2023, 11:00 am, Celis-116
link:
https://us02web.zoom.us/j/87933713466?pwd=WDg0dEU4SzR6Qyt3MTNFYWlLbmNwZz09

• Virtual- Dr. Manos Papadakis, University of Houston
Title: Fourier analysis methods inera of AL
March 14, 2023, 10:30 am
link: https://meet.google.com/urm-rhmx-dhw

• In person- Dr. Robledo Álvaro Lozado, Math Professor Connecticut University
Title: “A short proof of Fermats Last Theorem (for non-constant polynomials!)
March 16, 2023, 10:30 am, Celis-116

• Virtual- Dr. Andreas Mang, University of Houston
Title: Numerical methods for PDE-constrained optimization problems governed by hyperbolic equations. Tuesday, March 28, 2023, 10:30 a.m.
link: meet.google.com/urm-rhmx-dhw

• In person- Panel of Graduate Students (Silvia López, Mónica Colón, Ferney Henao, Geraldo Soto, Jhonnatan Ortega) Moderator: Dr. Luis Cáceres Duque
Title: From the master's degree at UPRM to the doctorate in the USA

Thursday, April 20, 2023, 10:30 am, Celis-116

• In person: Dr. E. Suazo, University of Texas, Rio Grande Valley
Title: Probabilistic solutions of fractional differential and partial differential equations and their Monte Carlo simulations
Monday, April 3, 2023, Time: 5:30 pm, Celis-116

• Onsite- Dr. Ken Ono, University of Virginia
Title: Talk for Undergrads: “What is the Riemann hypothesis, and why does it matter?
Tuesday, May 2, 2023, time: 10:30 am Celis-116

• In person: Dr. Ken Ono, University of Virginia
Title: New results in arithmetic statistics?
Thursday, May 4, 2023, time: 10:30 am Celis-116

ACHIEVEMENTS AND AWARDS

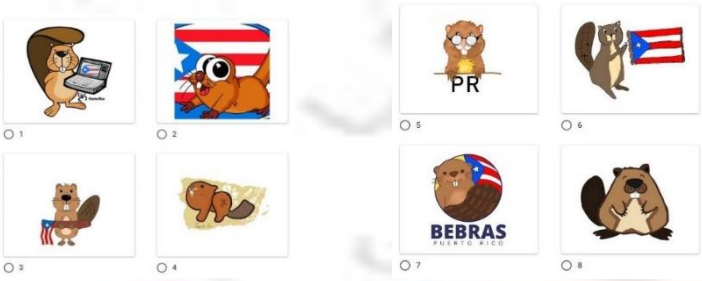
Dr. Reyes Ortiz- Gradmar Maldonado student received the "**Outstanding Poster Award 2022**", Agency: Mathematical Association of America, August 6, 2022.
• Dr. Alejandro Vélez Santiago- Poster, **Lathisms 2022**, https://uploads-ssl.webflow.com/5f3e96827894c2ff19996e36/631f03c49e73503e4c2e7f3f_Alejandro_Velez_Santiago.pdf
• Dr. Luis Cáceres and his team OMPR (**Ibero-American Mathematical Olympiad**) received 2 bronze medals.
• Dr. Luis Cáceres and his team OMPR (**International Mathematical Olympiad**) received Honorable Mention.
• Dr. Luis Cáceres and his team OMPR (**General Competition Mathematical Olympiad**) The Puerto Rican delegation obtained third place, tied with Cuba. First place: Mexico and second place: Colombia.
• OMPR obtained the **Bebras franchise (International Challenge on Informatics and Computational Thinking)** for Puerto Rico.
• Dr. Luis Cáceres and his team OMPR (**XXIV Mathematical Olympiad of Central America and the Caribbean** with the participation of 12 countries based in Costa Rica): Student Nirvana Marrero (Notre Dame, Caguas) gold medal, student Elsa Deshmukh (SESO, Mayagüez) bronze medal. Student Jerry Chen (Saint John San Juan) won an honorable mention.
Head of delegation: Sergio Manzanares (UPRM graduate student), Tutor: Dr. Omar Colón, Technical support: Dr. Edwin Flórez, Logistics manager: Dr. Luis Cáceres, Support: Ferney Henao, Julián Jiménez, Jhonnatan Ortega.
• **MS Graduates**-December 2022
Graduate students who completed their master's degree in our department in December 2022: Marcos Badillo (Pure Mathematics), Jesús Hernández (Statistics) and Jean Galán (Statistics).
BS Graduates- May 2023
Undergraduate students who completed their Bachiller in our department in May 2023: Gradmar E. Maldonado Martí, Michael Javier Love Rivera Serrano, Darío Cruzado

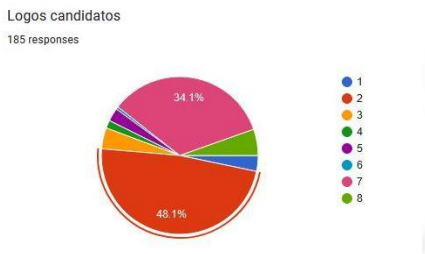
Padró, Pedro Felipe González Medina and Eric Javier Pabón Cancel (Pure Mathematics), Diego L. Rivera Correa, Lenier Gerena Meléndez, Eloi Esteban Torres Zapata, Adel F. Del Valle Pérez, Amarilys Otero Ayala, Aramis E. Matos Nieves, Harry Rivera Quintana, Francisco A. Carrero Cordero, Darell Arocho León, Víctor Andrés Navas Seijas, Darwin L. Fernández Sepúlveda, Jezreel Jehiel Maldonado Ruiz, Mariely Ocasio Rodríguez and Félix Manuel Pérez Quiñones (Computer Science); Daniel Omar Cintrón Cuevas and Sharimar Daniela Nieves Amado (Mathematics Education)

- **MS Graduates**- May 2023
  Graduate students who completed their master's degree in our department in May 2023: Eduar Andrés Castañeda Molina, Mónica Colón Vargas, Darwin Omar Gutiérrez Rodríguez, Ferney Henao Ceballos and Federico E. Macchiavelli Girón (Statistical Mathematics); Francisco J. De Jesús Pagan, Julián Andrés Jiménez Franco, Silvia María López Gallo, Offir Neil Romero Castro and Geraldo Enrique Soto Rosa (Pure Mathematics); Axi Fabricio Aguilera Martínez, Jason Josué Bermúdez Sarmiento and Haider Montes Masmela (Applied Mathematics); Besser A. Henríquez García (Scientific Computing); Lizbeth Alvarado Vargas, Gabriel León Prato and Jhonnatan Stiven Ortega Betancourt (Mathematics Teaching at the Pre-University Level)

- **BEBRAS**- (**International Challenge on Informatics and Computational Thinking**)
  Bebras is an international initiative that seeks to promote Informatics (Computer Science or Computing) and computational behavior among school students of all ages. Participants are directly supervised by their teachers, who also use the Bebras challenges to implement them in their teaching activities. The challenge is done in schools using computers or mobile devices. Computational thinking involves the use of a set of problem-solving skills and techniques that software engineers use to write programs and applications. The Bebras Challenge promotes problem-solving skills and computer concepts, including the ability to break complex tasks into simpler components, algorithm design, pattern recognition, and abstraction.

  This year the Department of Mathematics was named a provisional member of Bebras. Given this event, an internal competition was held to find the candidate logo that represented our institution. During the month of January, such a competition was held to find the winning logo. Eight (8) logos that were created between undergraduate students, graduates and professors participated. The competition received logos until Monday, January 30. On Tuesday, January 31, online voting was activated and on Friday, February 3 at 4:00 pm the winner was announced. The participating logos and their final result are shown below. The winner was logo #2.





G. To Impact Our Puerto Rican Society

- Mathematical Olympics of Puerto Rico, OMPR: Project directed by Dr. Luis F. Cáceres and co-directed by Dr. Arturo Portnoy, focused on students from grades 3 to 11 at the island level that prepare talented students through Saturday academies and summer camps to represent Puerto Rico in the IBERO Olympics, in the CENTRO Olympics and in the IMO Olympics. Also, the May Olympics, which is international at a distance.

- This project maintains its link with the community through its Puerto Rico Mathematical Olympics page (om.pr), which is managed by Dr. Luis F. Cáceres.

- Committees of the College Board.

- Mathematics conferences in schools throughout the island:

- Team coaches and judges of national and international Olympics:

- Science Fair Judges

- Institute for Mathematical Strengthening (INFOMATE).
  This is an intensive review that is strongly recommended for all students who do NOT obtain more than 50% in the Mathematics Diagnostic Exam offered by the RUM to new students to whom it applies. It has been extended to all high school students who wish to take an intensive review of the mathematical topics covered up to grade 12. Also, it has included all those people who need to refresh mathematical topics, especially those who enter the program of Professional Improvement.

H. TO STRENGTHEN SCHOOL SPIRIT, PRIDE, AND IDENTITY

The remodeling of the Luis Monzón building and the waiting time to complete the work is one of the factors that impact this component. Today, all phases are expected to be completed by December 2024.

Completing the remodeling of the building and restoring the Department of Mathematical Sciences, its academic, research and administrative facilities is the most pressing issue for our department and for the UPRM. As the entire university community is well-known, we are the department with the greatest service on the Campus. The lack of facilities with the technological needs that our department requires, the lack of spaces when preparing the academic schedule each semester, the excessive increase in the number of students per classroom to be able to meet the demand (coupled with the freezing of teaching positions and job nominations), the lack of flexibility to resolve urgent day-to-day situations, are some of the situations that impact the teaching-learning process and put the sense of belonging at risk. Daily interaction between faculty, non-teaching staff, and students is necessary for further growth in our department. This is more noticeable among the students of our different programs since they lost their office, unable to find a space to coordinate their academic, research and cultural activities. The relocation of our

department's staff and students throughout the Campus is affecting the fluidity of the emergence of new ideas, of more academic and research collaborations, as well as the academic fraternization that arises from an environment where personal contact arises naturally and spontaneous.

On the other hand, the closure of the FA and FB amphitheaters of the Physics Building due to their remodeling for the summer of 2023 had a direct impact on the following courses and sections offered for the First Summer of 2023. The main situation was the search for classrooms at the last minute with capacities of more than 90 students, since the precalculus I and II courses are offered in mega sections due to the demand they generate as they are necessary courses for the curricular of almost all the departments in the Campus.

Here's the breakdown:

FA Amphitheater- It would be used to teach the workshops of the Precalculus I and II sections that would be taught in FB.

FB Amphitheater

Schedule	Section	Enrolled	Course	Profesor
7:30 am- 10:10 am	01A	85	Mate 3063	Omar Colón Reyes
10:25 am- 1:05 pm	02A/02B/02C/02D/ 02E/02F/02G 02H/02I/02J/02K/0 2L/02M/02N	210	Mate 3172	Luis Cáceres Duque
1:20 pm- 4:00 pm	03A/03B/03C/03D/ 03E/03F	90	Mate 3172	Luis Cáceres Duque
Total, affected students:		**385**		

Most of the amphitheaters or halls that were requested before the remodeling of the amphitheaters were not available due to previous reservations from other departments. Faced with this situation, sections were closed and their capacity lowered. This decision economically affects the inflow of capital to the Administration, since many students, having no option, enrolled in other System Campuses and even in Private Universities. The FA and FB amphitheaters are rooms that allow the largest number of students to be served per academic period. These amphitheaters are also one of the few large-capacity service areas that our Campus has to offer conferences, workshops, student association meetings, activities during the orientation week of new students, student assemblies at the faculty level, and others. On the other hand, they are very important to offer the departmental and final exams of the lecture-type courses, the multi-sectional courses and the laboratory exams that are offered at the RUM.
The closure of these amphitheaters impacts the Department of Mathematical Sciences not only in summer enrollment, but will also impact the enrollment of the First Semester

2023-2024 given the situation of being the only amphitheaters of which we are custodians. It is an arduous and frustrating task to have to wait to accommodate our courses because the Monzón Building is not completely remodeled.

The Department of Mathematical Sciences provides service to all the students of the Mayagüez Campus, this should be taken into consideration before making drastic decisions that affect our students.

For the Department of Mathematical Sciences, it cannot be negotiable that its growth and development be limited for so many years, taking into consideration the great challenges that lie ahead in the fiscal situation of the UPR and the country. Despite this situation, our department remains firm in promoting and motivating our professors and students to raise the name of our university. It has been achieving this through efforts and initiatives that help complement the institutional budget that supports the sponsorship in the dissemination of its research, publications, posters, and findings at a national and international level, as well as the professional improvement necessary to maintain a dynamic and in constant growth.

J. INTERNATIONAL ACTIVITY

The Department of Mathematical Sciences has an internationally varied Faculty. Currently, we have 17 international professors and 21 graduate students who teach courses and workshops.

CONFERENCES, WORKSHOPS OR ORAL PRESENTATIONS GIVEN NATIONALLY OR INTERNATIONALLY

Dr. Omar Colón-Research and Technological Academic Development Windows of Costa Rica. August 2-4, 2022

Dr. Omar Colón-XXX Math Kangaroo Association Meeting, Cervia, Italia. Oct. 2-9, 2022

Dr. Paul Castillo- Discontinuous finite element methods for the simulation of Turing patterns in 2D/3D-50th anniversary of the Mathematics Career UNAH, July 15, 2022.

Dr. Paul Castillo- Conservative method for the numerical approximation of nonlinear Schrodinger systems UNAH School of Mathematics Colloquium, June 10, 2022.

Dr. Paul Castillo Postgraduate courses in Physics, Mathematics and Engineering in the USA: opportunities, myths and realities-UNAH School of Mathematics, April 8, 2022.

Dr. Alejandro Vélez Santiago- American Mathematical Society Southeastern Sectional Meeting-University of Tennessee at Chattanooga. October 16-17, 2022

Dr. Alejandro Vélez Santiago-XV Congress GAFEVOL 2022- Evolution equations and functional analysis group**-**National University of Colombia: Mazinales, November 28-Dic.2,22-Talk: “A priori estimates for generalized inhomogeneous local and nonlocal heat equations over irregular regions”.

Dr. Edwin Flórez-Conference- GMiS (Great minds in Stem)
Pasadena, California. October 6-8 2022.

Dr. Israel Almodóvar-Conference- Presentation of Investigation Project
“Initialization of k-means clustering using the empirical likelihood”.
Joint Mathematics Meeting (JMM) 2023
John B. Hynes Veteran’s Memorial Convention Center, Boston, MA. January 3-7 2023.

Dr. Luis Cáceres-Duque-INTED (17th Annual International Technology, Education and Development Conference)
Abstract presented: “How do mathematics teachers in Puerto Rico perceive the mathematics competitions?.
Authors: Ferney Henao, Luis Cáceres, Place: Valencia Spain, Date: March 6-8 2023

Dr. Omar Colón-Reyes-INTED (17th Annual International Technology, Education and Development Conference)
Abstract presented: “What are the problems like in the world’s largest International Mathematical Olympiad? -Authors: Meike Akueld, Luis Cáceres, Omar Colón
Place: Valencia España, Date: March 6-8, 2023

Dr. Alejandro Vélez Santiago-Workshop in MSRI/ SL Math: Critical Issues in Mathematical Education: Mentoring for Equity
Date: March 22-24, 2023
Place: University of California, Berkeley

Dr. Alejandro Vélez Santiago-Congress: The 2023 AIMS Conference on Dynamical Systems and Differential Equations
Date: May 31 thru June 4, 2023
Place: University of North Carolina, Wilmington

Dr. Reyes Ortiz- Title: Some Results on τn-factorization
Date: August 3-7, 2022
Place: Math Fest 2022, Philadelphia PA