



Focus on Mathematics is a unique partnership funded by the National Science Foundation to improve student achievement by providing mathematics teachers with the content knowledge and expertise most valuable in their profession.

In partnership with mathematicians and educators, **Focus on Mathematics** has created professional development

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FOCUS ON MATHEMATICS

MATHEMATICS EXPOSITION



THE PAVILION ON THE CHARLES RIVER
BOSTON MUSEUM OF SCIENCE
SCIENCE PARK
BOSTON, MASSACHUSETTS

Corporate Sponsors

We are extremely grateful to our Corporate Sponsors who share an enthusiasm for the enrichment of mathematics in the lives of all students. Their generous contributions helped make the 2006 Math Expo possible!

Holt, Rinehart and Winston

HRW is a recognized leader in secondary education publishing curriculum-based textbooks, support, reference materials, and professional development for students and teachers in grades 6–12. For more information, visit www.HRW.com.

MathWorks Inc.

The MathWorks is the world's leading developer of technical computing and Model-Based Design software, MATLAB and Simulink, for engineers and scientists in industry, government, and education. More than 3,500 universities around the world use MathWorks products for teaching and research in a broad range of technical disciplines. For more information, visit www.MathWorks.com.

Raytheon Company

The MathMovesU program is dedicated to improving the way American middle school students view math. Through MathMovesU, students can win exciting awards by answering celebrity-related math challenges online at www.MathMovesU.com.

Math Fair Support

We would like to recognize the support we received for our Math Fairs. In particular, we would like to thank Derek Kane of

DEKA Research & Development

for his presentation in Chelsea to students and teachers, and for his help in judging the Chelsea Middle School Math Fairs.

www.DekaResearch.com

We would also like to thank David Leschinsky of **Eureka!** for contributing mathematical puzzles and games in a co-sponsored fundraiser to support Math Fairs in the Chelsea Middle Schools.

www.EurekaPuzzles.com

Welcome!

Welcome to the 3rd annual **Focus on Mathematics** Math Expo. We are pleased to present this year's exhibit as an example of the dedicated work undertaken by nearly **2,000** middle and high school students in our five partner districts: **Arlington, Chelsea, Lawrence, Waltham, and Watertown.**

Students were mentored by their teachers, university mathematicians, college students, and in many cases, their parents, to develop over 1,000 research projects on various mathematical topics. The projects were then presented at district math fairs in 16 different schools. The ones here today were selected on the basis of mathematical content and depth, extent of research, creativity, effort, and presentation.

We would like to acknowledge all the students who participated in their local math fairs. These students demonstrated tremendous determination and effort to research and complete a challenging mathematical problem. In addition, it took a great deal of confidence and courage to present their projects to judges, teachers, and peers.

Due to an unprecedented storm that ravaged much of Lawrence, three schools had to cancel their Math Fairs. We wish to extend our heartfelt appreciation to the teachers and students who worked so hard on their projects despite the flooding in their homes and in their schools.

We commend every one of the students who participated in the development of a math research project and sincerely wish we could have included more. It gives us great pleasure to present the 102 projects in this exhibit, representing the work of 177 students. These students are eager to share their research experience, so we hope you will allow time for them to discuss it with you and answer any questions you might have.

We would like to thank you for coming to today's event to celebrate the outstanding achievement of students in our partnership. We hope you enjoy the afternoon!

Glenn Stevens

Boston University

Wayne Harvey

EDC, Inc.

Al Cuoco

EDC, Inc.

Principal Investigators for **Focus on Mathematics**

Student Projects by District and School

Teachers listed with each school are those with students who participated in district Math Fairs and/or who assisted or judged at the fairs.

ARLINGTON SCHOOL DISTRICT

Superintendent – Nathan Lee Levenson
Assistant Superintendent – Kevin Hutchinson
FoM District Leader – Kathleen Bodie

ARLINGTON HIGH SCHOOL

Principal – Charles A. Skidmore
Teachers – Jon Bookston, Octavia Brauner, Al Flanders, Nigel Kraus,
Jane Martin, Chris Martino, Hugh Morgenbesser, Kent Werst,
Ruth White, and Kambiz Vatan

A MODEL FOR DEFYING GRAVITY: JUGGLING

Katherine Smith (Grade 10)

COST-BENEFIT ANALYSIS OF MONOPOLY

Rebecca Brown (Grade 10)

DATA MINING

John Coglianese and Thomas Liu (Grade 12)

GEOMETRY OF POOL

Adam Formica, Brian Lynch, and Ramanjit Singh (Grade 9)

INFANT MORTALITY RATE

Laura Leone and Fiona Peoples (Grade 9)

LEONHARD EULER – POLYHEDRA FORMULA

Steve Carmody (Grade 10)

PATTERNS IN POETRY:

THE MATHEMATICAL DIMENSIONS OF LANGUAGE

Mary DeCamp (Grade 10)

Volunteers

We are very appreciative for all of the dedicated teachers, coaches, and administrators who have been helping to coordinate the Math Fairs in their schools. In addition, many of you have offered to volunteer at the Registration table. It is due to this collaborative district-wide support that we are able to exceed all expectations. A big thank you goes to:

Kathy Bodie	Ann Halteman
John Bookston	Eileen Herlihy
Matthew Chedister	Marek Janota-Bzowski
Donna Chevaire	Michael Russo
Anne Cook	Susan Skaff
Tom DeSisto	Sarah Sword
Kathy Foulser	Bob Weldin
Chuck Garabedian	Ruth White

Special Citations

In recognition of our students' Math Expo achievements, many state officials sent congratulatory citations. We are grateful to the following list of distinguished representatives who issued these special awards:

ARLINGTON

Representative Jay R. Kaufman
Representative J. James Marzilli
Representative Anne M. Paulsen

CHELSEA

Representative Kathi-Anne Reinstein

LAWRENCE

Senator Susan A. Tucker
Representative Barry R. Finegold
Representative William Lantigua
Representative David M. Torrissi

WALTHAM

Senator Susan C. Fargo
Representative Peter J. Koutoujian
Representative Thomas Stanley
Mayor Jeannette A. McCarthy

WATERTOWN

Representative Rachel Kaprielian
Representative Peter J. Koutoujian

Thank you all! The Math Expo is indeed the result of a partnership effort and is a wonderful testimony of our mathematical community.

Acknowledgements

Focus on Mathematics would like to extend its sincere thanks to many people who contributed to the success of the 2006 Math Expo. We greatly appreciate the support of our district superintendents and principals; the dedicated effort of the *FoM* District Leaders; and the steadfast commitment of the teachers who worked with and supported their students throughout the entire process; and most especially to the students for their many hours of hard work and for their commitment to their own learning and success. It has been a privilege to be involved with such bright, energetic students!

A very special thank you goes to Ava Berinstein, our Math Fair and Expo Coordinator, and to the collaborative efforts of an incomparable team comprised of Edna Chiu from BU, and Karina Dymina and Jill Vollmuth from EDC, Inc. for assisting in multitudinous ways! Thanks also goes to Kevin Duong of BU for help with Registration. In addition, we would like to recognize the contribution of university students, volunteers, and our local state officials for their support of student learning and achievement.

University Students

Many mathematicians and mentors are needed to help review the students' projects at the Math Fairs. This year, we were very fortunate to have students from WPI and UMass Lowell help review projects. In addition to judging, the UMass Lowell students played an integral role in the classroom and worked with Lawrence students in the Oliver, Parthum, and SLE middle schools.

UMass Lowell

Teresa Hecht, Mentor
Andrew LaRoque, Mentor
David Stanley, Mentor

Worcester Polytechnic Institute

Wendy Chen	Casey Richardson
Gerardo Hernandez-Correa	Brian Skjerven
Mary Kortz	Daniel Smalz
Melissa Moon	Rebecca Wasyk

ARLINGTON SCHOOL DISTRICT,

CONTINUED

PROOF BY EXHAUSTION

Jeffrey Lim (Grade 9)

RICHTER COMES CRASHING DOWN ON LOGARITHMS

Erin Kelly (Grade 10)

STATISTICAL ANALYSIS OF THE SOPHOMORE CLASS

Erin Bessette-Kirton, Fecilica Bishop, Jean Dao, and Melissa O'Connell
(Grade 10)

THE FUNDAMENTALS OF NUMBER THEORY

Bobby McWatters (Grade 10)

VERHULST EQUATION

Miranda Forman (Grade 10)

OTTOSON MIDDLE SCHOOL

Principal – Stavroula I. Bouris

Teachers – Fenna Beverly, Dennis Doble, Larry Greco,
Nella LaRosa-Waters, and Linda Tomilson

CATALAN NUMBERS

Ben Kuhn (Grade 8)

FABULOUS FIBONACCI

Emily Fuller, Molly Lobel, and Phoebe Rosen (Grade 8)

INSCRIBED CIRCLE IN A TRIANGLE

Han-Chin Shing (Grade 8)

THE SUBWAY PROBLEM

Natalie Duranceau (Grade 6)

WHAT'S IN A CODE?

Caroline Donovan and Maria Lobo (Grade 7)

CHELSEA SCHOOL DISTRICT

Superintendent – Thomas S. Kingston
Assistant Superintendent – Mary Bourque
FoM District Leader – Andrea Pulver
CSR Math Specialist – Kathy Foulser
Curriculum Specialist – Ann Halteman

JOSEPH A. BROWNE SCHOOL

Principal – Cove J. Davis
Teachers – Patricia Burke, Roseanne Cataldo, Michelle DeMaino,
Christina DiCalogero, Kate Furtado, Christine Graziano, Evan Janow,
Jacquelyn Kelliher, Catherine Marciello, and Mary Valentine

COMPUTERS

Parth Mishra (Grade 7)

INDIRECT MEASUREMENT

Hans Hoffens Rivera and Yen Pham (Grade 7)

PICK'S THEOREM

Saira Delgado and Savannah Sheehan (Grade 5)

PROBABILITY

Robert Connors, Marisol Francisco, and Jorman Mota (Grade 5)

REAL FACTOR TREE

Alexandria Hensey and Adais Hernandez (Grade 6)

EUGENE WRIGHT SCHOOL

Principal – Donna R. Covino
Teachers – Rhonda Block, Kerri Centrella, Gloria Colosi,
Melinda Frangie, Ruth Kearns, Laura King, Elisa Pentruzella,
Melissa Skolnik, Shige Tanaka, Kathy Trevor, and Abigail Woodbury

BALANCING AND CATCHING

Jennifer Maldonado and Hien Pham (Grade 5)

BIGGEST BUBBLE

Jennifer Ochoa and Tatiana Vaquerano (Grade 5)

BLACK JACK

Mario Garcia (Grade 6)

Mathematicians & Educators

The Math Fairs that are conducted at each of the schools puts students and teachers in the *Focus on Mathematics* partnership in direct contact with mathematicians. This has given many students the opportunity to experience mathematics as a scientific discipline and to be mentored on their projects by a team with a classroom teacher working alongside a university mathematician, and in some cases, university students. A deep gratitude goes to two mathematicians who served as the Math Expo Advisors and played key roles in the organization of the research projects and in the review of research projects; both mathematicians have put forth an unconditional commitment to the Math Fairs and Expo:

Art Heinricher

Worcester Polytechnic University

Dick Hall

Boston University

Many thanks go to our other *Focus on Mathematics* partners for their dedication and commitment to the learning of mathematics for all students:

Boston University

Paul Blanchard	Suzanne Chapin
Robert Devaney	Carol Findell
Marvin Freedman	David Fried
Carole Greenes	Emma Previato
Steve Rosenberg	Glenn Stevens

EDC, Inc.

Al Cuoco	Steve Benson
Wayne Harvey	Sarah Sword

UMass Lowell

Al Doerr	Ken Levasseur
James Graham-Eagle	Marvin Stick

Worcester Polytechnic Institute

William Farr
Suzanne Weekes
Bogdan Vernescu

WATERTOWN SCHOOL DISTRICT

Superintendent – Steven A. Hiersche
Assistant Superintendent – Stephen Gould
FoM District Leaders – Chuck Garabedian and Dan Wulf

WATERTOWN HIGH SCHOOL

Principal – Paul M. Noftsker
Teachers – Stephen Harrington, Jonas Kalish, Mike Spillane,
and Karen Trenholm

ARE WE A CAFFEINATED SOCIETY?

Helen Trinh Pham (Grade 12)

BOSOX VS. YANKEES

Matthew Sullivan (Grade 12)

CONSECUTIVE NUMBER PROBLEM

Christina Ioannidis and Levi Thornton (Grade 10)

FROG AND TOAD PUZZLE

Immy Yu (Grade 11)

GEOMETRIC FIGURES EMBEDDED IN ORIGAMI

Li Ya Zhu (Grade 10)

MANNY RAMIREZ VS. DAVID ORTIZ

Steven Tramontozzi

MOVIE WATCHING

Garen Chiloyan and Harout Chouljian (Grade 11)

ORIGAMI: TWO COLLIDING CUBES

Maya Pardo (Grade 10)

RISK PROBABILITIES

Vivian Brown and Joanna Rosene-Mirvis (Grade 11)

SIMPLE ORIGAMI

Sophia Goutzinos and Hong Van Phan (Grade 10)

TIC-TAC-TOE: NOUGHTS AND CROSSES

Alisa Aylward (Grade 10)

YEARS OF COLLEGE VS. SUBJECT INTERESTS

Paul Moan and Timothy Watts (Grade 11)

CHELSEA SCHOOL DISTRICT,

CONTINUED

EUGENE WRIGHT SCHOOL, CONTINUED **CULTURE**

Jerickson Fedrick, Kenlli Santana, and Crystal Starkey (Grade 6)

FAVORITE COMEDY MOVIE

Warda Arman and Deandra Cora (Grade 6)

HEART RATES

Cindy Cruz and Kadiatu Kamara (Grade 5)

PENTOMINOES

Richard Arsenault and Angel Ramirez (Grade 7)

WHAT DO 6TH GRADERS WANT TO DO WHEN THEY GROW UP?

Bhagyashree Patel (Grade 6)

WHICH GENDER RUNS FASTER?

Anny Hernandez Chicas and Deina Mejia (Grade 5)

CHELSEA HIGH SCHOOL

Principal – Morton Orlov

Teachers – Angela Botticelli, William Carrow, Susan Castella,
Ana Mateos, Deborah Miller, Kevin Wynn, and Emily Romano

COMBINATIONS TO A MASTER LOCK

Katherine Palencia (Grade 11) and Joseph Yablonsky (Grade 10)

LIMITS

Stephanie Murcia and Katherine Tejada (Grade 11)

MY FIRST CAR

Edress Ghulam (Grade 9)

PI CALCULATIONS

Shikeba Shirzay (Grade 10)

THE AREA OF THE ARBELLOS

Jonathan Lopez and Daniel Rendon (Grade 9)

VOLUME

Abdullahi Sidow (Grade 9)

LAWRENCE SCHOOL DISTRICT

Superintendent – Wilfredo T. Laboy
Assistant Superintendent, Curriculum and Instruction – Gail Rosengard
FoM District Leader – Donna Chevaire
Curriculum Facilitator Mathematics K-5 – Heidi Price
Curriculum Facilitator Mathematics 6-12 – Anne Cook

ARLINGTON MIDDLE SCHOOL

Principal – Juan Rodriguez
Math Coach – Ellen Murray
Teachers – Lynne Yarrows

MARATHON

Denis Mendez (Grade 7)

ALEXANDER B. BRUCE SCHOOL

Principal – William J. Sullivan
Math Coach – Susan Skaff
Teachers – Michelle LaRocque, Jane Sheehan, and Phyllis Unger

FIBONACCI IN NATURE

Mohamaris Hasan and Jazmin Minaya (Grade 6)

DO KIDS DRINK MORE WATER OR MILK?

Joshua Pare (Grade 6)

GEOMETRIC SHAPES

Joshua Morales (Grade 6)

INPUT/OUTPUT!

Freddie Burgos and Christopher Pagan (Grade 6)

MATH DATA IN A SLEEP STUDY!

Carldyn Grulon, Mariah Makarewicz, and Thais Moron (Grade 8)

ORIGAMI

Luis Bautista and Jairo Cabrera (Grade 6)

WALTHAM SCHOOL DISTRICT,

CONTINUED

WALTHAM HIGH SCHOOL

Principal – John B. Graceffa
Teachers – Jessica Bella, Matthew Chedister, Brooks Deering,
Thomas DeSisto, Amy Doherty, Lawrence Doxsey, Ami Fasulo,
Marianne Genova, Madeline Litopoulos, Kathryn Mahoney, Lisa McNulty,
Michael Russo, and Michael Sparkes

BANK INVESTMENTS

Adriana Giron (Grade 11)

BOYS AND GIRLS CLUB ACTIVITIES

Lissette Velez (Grade 12)

BUYING VS. LEASING VS. SAVING THEN BUYING

Brad Desai (Grade 11)

DESIGNING A SWIMMING POOL

Lien Phung (Grade 9)

FOOTBALL: OFFENSE VS. DEFENSE?

Mike Annino and Al Digiacoimo (Grade 11)

PICK'S THEOREM

Shirley Charles and Jennifer Tran (Grade 10)

PROJECTILE MOTION

Shannon McGratton (Grade 9)

THE BIRTHDAY PARADOX

Nicole Hanley and Michelle Saulnier (Grade 10)

THE MATHEMATICS OF HURDLING

Deborah Caruso and Kaitlyn Cedrone (Grade 11)

THE SUM OF CONSECUTIVE DIGITS

Candace Cobuzzi and Kim Laguna (Grade 10)

TOWERS OF HANOI

Julia Paltseva (Grade 10)

WHICH STATISTICS ARE THE BEST PREDICTORS IN BASEBALL?

Jonathan Hession (Grade 9)

WALTHAM SCHOOL DISTRICT

Superintendent – Susan I. Parrella
Assistant Superintendent, Curriculum and Instruction – Alexander Wyeth
FoM District Leader – Eileen Herlihy

JOHN F. KENNEDY MIDDLE SCHOOL

Principal – John F. Cawley
Teachers – Ann Ciccarella, Beverly Giblin, Kristine Severino, and Leah Walton

FAIR OR UNFAIR?

Angie Tocci (Grade 7)

POOL PATTERNS: REFLECTIONS ON REFLECTIONS

Jeremy Kacher and Nathan O'Brien (Grade 8)

ROUND THE BLOCKS

Matthew Ng (Grade 8)

SERPINSKI'S GASKET

Kristin Kelly and Steven Krueger (Grade 8)

SUDOKU

Victoria Tran and Rachael Wheaton (Grade 8)

JOHN W. McDEVITT MIDDLE SCHOOL

Principal – Brad M. Morgan
Teachers – Nancy Cooley, Mike Coppolino, Pat Maloney, Christine Mulroney,
Jeanne Penrod, Paul Perz, Jerry Slavat, and Ann Marie Varella

FIBONACCI PATTERNS

Michelle Kudlate and Grace Wakefield (Grade 6)

HOW FAST WOULD RUMORS SPREAD?

Carolina Macedo and Maria Santiago (Grade 7)

ICE CREAM-COMBINATION

Hana Machover and Catherine McQuestion (Grade 6)

PYTHAGOREAN THEOREM

Richard Thomas (Grade 8)

SCALE DRAWING

Matthew King and Natalie Viyaran (Grade 8)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

ROBERT FROST SCHOOL

Principal – Ellen M. Baranowski
Math Coach – Jacqueline Angelari
Teachers – Mike Guertin, Rebecca Heggarty, Kourtney Kane,
and Jill Robinson

ANIMALIZE

Marissa Ard and Krystal Mannion (Grade 7)

HOW BIG IS A BARBIE? (PROPORTIONS)

Heather Le, Miriah Perry, and Kamila Souza (Grade 8)

INFINITY

Val Rodgers and Kim Truong (Grade 6)

THE MONTY HALL EFFECT

Diana Figuereo and Teal Kahn

THE PYTHAGOREAN THEOREM

Julio Melendez and Katie Suliveras (Grade 8)

GERARD A. GUILMETTE SCHOOL

Principal – Daniel J. Hanneken
Math Coaches – Suzanne Hickey, Patrice Holt, and Mary Samperi-Giordano
Teachers – Elizabeth Carr, Tracy Cogan, Angela Conte, William Driscoll,
Joe Martone, Willie Mejias, Kristen Robinson, and Paula Sideri

ANGLES OF A PENTAGON

Chantel Colon, Dayonara Diaz, and Yvaliza Rodriguez (Grade 5)

BASIC FINGERPRINT PATTERNS

Rafael Belliard, Luis Cortez, and Henry Marte (Grade 5)

READ ALL ABOUT IT

Darlene Garcia, and Tatiana Rivas (Grade 7)

SHAPE UP AND SHIP OUT

Chantayra Moscoso (Grade 7)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

GERARD A. GUILMETTE SCHOOL, CONTINUED

VOLUME OF PENNIES

Luis Caraballo, and Adam Potter (Grade 7)

HENRY K. OLIVER SCHOOL

Principal – Beth A. Gannon

Math Coach – Pat Nastasi

Teachers – Michelle DeCoste, Cathy Fisher, Mary Guerrero,
Margaret Lynch, Nancy Santoro, and Amy Sullivan

A PRINTER'S PROBLEM

Katherine Jaime and Courtney Russell (Grade 8)

BIRTHDAY GRAPH

Jesus Martinez (Grade 5)

CALLING ALL STUDENTS

Vlaimy Mejia (Grade 7)

CAPACITY AND VOLUME

Luis Rosario (Grade 6)

HUGO'S TOWER

Hugo Dominguez and Sebastian Jimenez (Grade 8)

THE FROG LOG

Ana Marte, Jose Morales, and Franylis Moncion (Grade 8)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

EDWARD F. PARTHUM

Principal – Sharman Sullivan

Math Coach – Lubica Vidrine

Teachers – Albert Blanchette, Deborah Bonilla, Gary Deabay,
and Mary DiMare

DO YOU KNOW YOUR MATH?

Samantha Garay, Stephanie Guzman, and Jennifer Herrera (Grade 7)

HIGH MEASURES

Chienell Coleman, Stephanie Ouk, and Nicole Villar (Grade 6)

SOUTH LAWRENCE EAST

Principal – Dina Hickey

Teachers – Lee Ann Canzano, Donna DiZoglio, Paul Frangos, Christine
Kalil, Catherine Lally, Susan Morandi, Diane Trainor, and Carol Watts

ENLARGING PICTURES

Leslie Peralta (Grade 7)

GRAPH IT, LEAF IT, ENLARGE IT

Krystal Parra, Jodezie Rodriguez, and Julianne Vargas (Grade 8)

HOW MANY JELLYBEANS ARE IN THE JAR?

Liam Cusack, William Van, and Netra Yung (Grade 6)

POPULATION DENSITY

Tung Nguyen and Mary Moriaty (Grade 7)

PROBABILITY

Stephanie Deleon, Beronica Paulino, and Brittney Stetler (Grade 6)

STOPPING SNEAKY JETER

Analuz Beras, Elizabeth Mercado, and Bianca Reyes (Grade 8)
