



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 programs in school districts and a new Master of Mathematics for Teaching degree at Boston University.

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Focus on Mathematics is funded by the National Science Foundation under grant no. 0314692. Any opinions, findings, and conclusions or recommendations expressed in our programs do not necessarily reflect the views of the National Science Foundation.

FOCUS ON MATHEMATICS

MATHEMATICS EXPOSITION



JUNE 9, 2007

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

Acknowledgements

Math Fairs put students and teachers in the *Focus on Mathematics* partnership in direct contact with mathematicians, giving students the opportunity to experience mathematics as a scientific discipline. We are particularly grateful to our two Math Expo Advisors who continue to play a critical role in the development and review of research projects. Thanks for your unconditional commitment to the Math Fairs and Expo.

Art Heinricher

Worcester Polytechnic Institute

Dick Hall

Boston University

A very special thank you goes to Ava Berinstein, our Math Fair and Expo Coordinator. We also want to thank the graduate students and faculty at Boston University, UMass Lowell, and Worcester Polytechnic Institute for working alongside students on their mathematical investigations and helping to judge the over 2500 student projects in our math fairs. Moreover, we are very appreciative of the dedicated teachers, coaches, and administrators who have helped to coordinate the Math Fairs in their schools. We are also thankful to the many individuals who have volunteered to help out at the Expo. It has been a privilege to be involved with such a bright and energetic group!

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 2007 Math Expo possible!

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Welcome!

Welcome to the 4th annual *Focus on Mathematics* Math Expo. We are pleased to present this year's select exhibit of the dedicated work undertaken by over **2,500** students in grades 4 through 12 in our five partner districts: of **Arlington, Chelsea, Lawrence, Waltham, and Watertown.**

Students were mentored by their teachers, university mathematicians, industrial scientists and engineers, graduate students, and in many cases, their parents, to develop exceptional mathematical research projects. The 157 projects on display today were selected from over 1,500 projects at 18 separate math fairs on the basis of their mathematical depth, extent of research, creativity, effort, and presentation.

We would like to commend all of the students who participated in their local math fairs. These students demonstrated tremendous determination and effort in their perseverance with a challenging mathematical problem. It also took a great deal of confidence and courage to present their projects to judges, teachers, and peers. We sincerely wish we could have included more of these wonderful projects in the Expo.

It gives us great pleasure to present the 157 projects in this exhibit, representing the work of 302 students. These students are eager to share their research experience with you, so we hope you will allow time for them to discuss it with you and field any questions you might have. 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*

ARLINGTON SCHOOL DISTRICT

ARLINGTON HIGH SCHOOL

ANAMORPHOSISM

Lauren Adelman (Grade 10)

BINARY ARITHMETIC AND BOOLEAN ALGEBRA:

INTERCONNECTIONS

Theodore Dokos (Grade 11)

BIOLOGICAL SCALING

Jacqueline Devigne and Robert McWatters (Grade 12)

COOKIN' YOUR NOODLE (RAMEN NOODLE INVESTIGATION)

William Dramstad (Grade 10)

CONVERSATION CONUNDRUM

Lindsay Culbert-Olds and Sonya Entova (Grade 10)

THE DANCE OF BEES

Amanda Chin and Phoebe Rosen (Grade 9)

ENERGY CONSERVATION (CELL PHONE CHARGERS, SHAVERS)

Callie McHugh and Emma Whitford (Grade 11)

EXPONENTIAL GROWTH/DECAY WITH WATER FLOW

Ritwik Bhattacharya (Grade 12)

THE FOURTH DIMENSION

Charles Ekhaus and William Seligson (Grade 9)

FREE TRADE

Miranda Forman (Grade 11)

WATERTOWN SCHOOL DISTRICT

WATERTOWN HIGH SCHOOL

THE 4-COLOR THEOREM

Ani Hakobyan (Grade 11)

CASUALTIES IN THE IRAQ WAR

Charlie Beagan (Grade 12)

CHINA'S ECONOMY AND ITS PEOPLE

Philip Chen (Grade 12)

THE NUMBER THEORY OF CICADA INVASIONS

Timm Moan (Grade 9)

**DOES SOCIOECONOMIC STATUS AFFECT
ACADEMIC OUTCOMES?**

Lisa Conti (Grade 12)

LEAP YEARS

Asa Oines (Grade 9)

LOST: THE NUMBERS AND VALENZETTI EQUATION

Clara Gibbons (Grade 9)

MAGIC SQUARES

Awesta Yaqubi (Grade 9)

ORAGAMI

Sophia Goutzinos and Sayaka Shishido (Grade 11)

PASCAL'S TRIANGLE

Regina Moroso (Grade 9)

PYTHAGOREAN THEOREM

Julie Alhady and Mariam Sukaisyan (Grade 9)

STATS IN BLACKJACK

Mike Callahan (Grade 11)

TRIGONOMETRY

Aous Hamad (Grade 9)

WALTHAM SCHOOL DISTRICT

CONTINUED

JOHN F. KENNEDY MIDDLE SCHOOL,

CONTINUED

NEW ENGLAND STATE QUARTERS

Katrina Ferguson and Catherine McGurrin (Grade 6)

THE SWORD OF KNOWLEDGE

Peter Muscato (Grade 8)

JOHN W. MCDEVITT MIDDLE SCHOOL

CRYPTOLOGY

Robyn Lindsay and Danna Ni Sai (Grade 8)

DIGITAL PUZZLES

Yuval Biran, Rachel Kiesling, and Emily Tiverio (Grade 6)

FIBONACCI

Jennifer Bourque and Maria Santiago (Grade 8)

GEOMETRY-LINES

Rutul Patel (Grade 7)

HOPPING FROGS

Emma Scalisi and Zipora Solis (Grade 6)

ISLAMIC ARCHITECTURE

Salma Yehia (Grade 8)

THE MYSTERY OF PI

Andrew Cohen (Grade 8)

NUMBER OF LICKS FOR A TOOTSIE POP

Meghan Brophy and Kelsey Fagan (Grade 8)

NUMBERS WITH MANY DIGITS

Tim Mahony and Eric Ward (Grade 8)

TEEN SLEEPING

Michael Bonadio and Justin English (Grade 8)

ARLINGTON SCHOOL DISTRICT,

CONTINUED

ARLINGTON HIGH SCHOOL, CONTINUED

FUSION RATE IN A CELL (GAUSSIAN DISTRIBUTION)

Hazel Briner (Grade 12)

GENETICS

Morgan King (Grade 11)

THE GOOGLE PAGE RANK ALGORITHM

Daniel Nass (Grade 10)

INFINITY

Yana Vierboom (Grade 12)

MATHEMATICAL BLACK HOLES

Adam Formica (Grade 10)

THE MATHEMATICS OF MONOPOLY

Kathleen People, Rose Sawyer, and Seneca Spargo (Grade 9)

THE MATHEMATICS OF SUPERHEROES

Heather Kobayashi, Alex Long, and Jule Pattison-Gordon (Grade 10)

MEDIA'S CRITERIA OF THE PERFECT WOMAN

Brianna Cronin and Lindsey Mills (Grade 12)

P = NP?

Galen August (Grade 11)

PAPER AIRPLANES

Patrick Cronin and Daniel O'Loughlin (Grade 12)

PUBLIC-KEY CRYPTOGRAPHY

Jeffrey Lim (Grade 10)

STATISTICS OF LIFE

Kostya Gorbunov (Grade 9)

VOTING THEORY

Thomas Liu and John Coglianese (Grade 11)

ARLINGTON SCHOOL DISTRICT,

CONTINUED

OTTOSON MIDDLE SCHOOL

INITIAL EXPLORATIONS/LINEAR & QUADRATIC EQUATIONS

Caroline Donovan and Maria Lobo (Grade 8)

M&M GEOMETRY

Alyssa Murray, Emily Molloy, Rebecca O'Leary, and
Sonia Zacher (Grade 6)

CHELSEA SCHOOL DISTRICT

CHELSEA HIGH SCHOOL

CAN INFINITY BE PLOTTED ON A GRAPH?

Jonathan Lopez and Daniel Rendon (Grade 10)

EGYPTIAN PYRAMIDS

Jimmy Aguilar and Yasky Valdez (Grade 11)

THE FOURTH DIMENSION

Maurissa Anderson and Faisa Sharif (Grade 9)

HISTORY OF BRIDGES

Katie Burke (Grade 10)

MATHEMATICS AND CRIME

Judith Garcia (Grade 10)

ORAGAMI

Valerie Mercado (Grade 9)

SIGNIFICANCE OF THE NUMBER E

David Darveash and Dhruv Darvesh Patel (Grade 11)

JOSEPH A. BROWNE SCHOOL

COMPARING SAFETY OF TRANSPORTATION TYPES

Jessica Jimenez-Rivera, Tania Luna Cardenas, and Amanda Malvasia
(Grade 8)

WALTHAM SCHOOL DISTRICT

WALTHAM HIGH SCHOOL, CONTINUED

CONSONANT AND DISSONANT

Tom Cincotta and Alyssa Navarro (Grade 10)

CURRYS PARADOX

Michelle Saulnier (Grade 11)

EINSTEIN'S CHALLENGE

Joe Rayne and Victoria Tran (Grade 9)

GEOMETRY IN SOCCER AND POOL

Ogi Rapaic and Pablo Teran (Grade 9)

PICK'S THEOREM

Alina Bahlavouni and Colleen O'Donnell (Grade 9)

PROBABILITY IN GENETICS

Sudha Chigurupati and Bhavi Patel (Grade 9)

PROPERTIES OF THE ARBELOS

Peter Hsi (Grade 9)

SACRED GEOMETRY

Lien Phung, Lauren Rudnick, and Rebecca Traite (Grade 10)

SMART ART

Paula Le, Amanda MacDonald, and Colleen Monaghan (Grade 9)

JOHN F. KENNEDY MIDDLE SCHOOL

GRASSHOPPER JUMPFEST

Anthony Cacciatore and Johny Chang (Grade 7)

HOW MANY CHOCOLATE CHIPS CAN FIT IN THE ATLANTIC OCEAN?

Brittaney Bonhomme, Kelsey Golden, and Kate Williams (Grade 6)

ICE CREAM ANYONE?

Nicolas Fandino (Grade 8)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

SOUTH LAWRENCE EAST MIDDLE SCHOOL, CONTINUED

FOLDING PAPER AND POWERS OF 2
Liane Arroyo and Nilckia Ortiz (Grade 7)

MY BIG CHOCOLATE CHIP COOKIE
Jennifer Cruz and Ana Santos (Grade 8)

PYTHAGOREAN THEOREM
Tung Nguyen, Raymond Rodriguez, and Roberto Zayes (Grade 8)

ROCK, PAPER, SCISSORS: IS IT A FAIR GAME?
Crismeldy Minaya and Cathleen Tellez (Grade 5)

TRIANGLE STRENGTH
Janer Reyes (Grade 7)

WHAT IF YOU FORGOT YOUR COMBINATION?
Luisa Arce, Crystal Delviloar, and Massiel Perez (Grade 6)

EMILY G. WETHERBEE SCHOOL

BIRTHDAY PARADOX
Priscilla Corado, Kassandra Pirela, and Yamil Varela

WALTHAM SCHOOL DISTRICT

WALTHAM HIGH SCHOOL

BURDENS OF A SPEEDING TICKET
Amanda Micco and Robert Paige (Grade 11)

CALCULUS - FIRE SWAMP RODENTS AND SNAKES
Peter Iodice (Grade 12)

CLOBBER
Garin Habeshian and Ajith Thomas (Grade 9)

CHELSEA SCHOOL DISTRICT,

CONTINUED

JOSEPH A. BROWNE SCHOOL, CONTINUED

EFFECTS OF GLOBAL WARMING
Hadassa Mikalixen and Yareli Sanchez Arenas (Grade 5)

INDIRECT MEASUREMENT
Mursal Hassan and Elsa Nunez Guerra (Grade 7)

MATH MAZE
Malik Chappell, Robert Connors, and Jorman Mota (Grade 6)

MEASUREMENT--BUILDING A MODEL HOTEL
Edgar Ocana (Grade 7)

NUMBER THEORY--15 STICKS GAME
Bryan Cardenas Sorto and Sean Quiroz (Grade 7)

PATHS
Ugliesa Cvjetan, Ricky Sorn and Anthony Donatelli (Grade 8)

SPILLED MILK AND CRITICAL ANGLES
Thien Ly Che (Grade 7)

VOLUME OF FLAT-TOP VS. POINTED SHAPES
Jayson Bowes and Jeffrey Lopez Santizo (Grade 5)

CLARK AVENUE SCHOOL

DO ADULTS KNOW MORE THAN KIDS?
Karina Perez and Maria Romero (Grade 5)

GEOMETRY MADNESS
Karen Flores, Charisse Thompson and Kassandra Toro (Grade 5)

PENCILS TO AUSTRALIA
Kimberly Martinez, Yessenia Motta, and Amber Rodriguez (Grade 5)

SHEETS OF TOILET PAPER ON A ROLL
Kassandra Diaz (Grade 8)

CHELSEA SCHOOL DISTRICT,

CONTINUED

CLARK AVENUE SCHOOL, CONTINUED

STATISTICS OF SKITTLES

Jasmine Ramos, Cassey Roosa, and Angelica Vargas (Grade 6)

EUGENE WRIGHT SCHOOL

\$1 A DAY VS. 1¢ DOUBLED FOR 30 DAYS

Jonathan Barahona and Alejandro Calderon (Grade 5)

CAFFEINE

Jacqueline Elias and Zehra Mirzai (Grade 8)

EARTH STATUS

Bhagyashree Patel (Grade 7)

GRADE LEVEL VS. MAD MINUTE PERFORMANCE

Marsha Mars and Kenia Santana (Grade 5)

HOW OFTEN ARE SONGS PLAYED ON THE RADIO?

Daiana Alonso Velzquez and We'aam Arman (Grade 5)

MULTIPLYING POLYNOMIALS

Jeffrey Restrepo Herrera and Keven Umana (Grade 5)

PROBABILITY

Darcy Smith (Grade 6)

TANTRIX

Irvin Benitez and Elvis Mancio (Grade 5)

LAWRENCE SCHOOL DISTRICT

LAWRENCE HIGH SCHOOL

HOW COMPUTER SCIENCE RELATES TO MATH

Hank Ibell, Jr. and David Muchene (Grade 10)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

HENRY K. OLIVER SCHOOL, CONTINUED

WHO PLAYS MORE VIDEO GAMES: BOYS OR GIRLS?

Jamilette Javier, Denisse Paulino, and Leticia Rosario (Grade 4)

EDWARD F. PARTHUM

COKE AND DIET COKE

Karolina Hernandez, Cyrena Mears, and Grace Nolberto (Grade 8)

COMPARING SPACES

Jasmine Guerrette, Tyana Rivera, Alisha Vargas, and Nalyn Yim (Grade 6)

FIBONACCI NUMBERS AND RATIOS

Jasmin Medina and Camila Moreno (Grade 6)

MAYAN NUMBERS

Brian Lopez (Grade 8)

OUR NUMERAL SYSTEM

Cheyenne Fowler (Grade 6)

USING RATIOS AND PROPORTIONS

Anthony Alicea, Nicole Villar, and Spencer Wilson (Grade 7)

SOUTH LAWRENCE EAST ELEMENTARY SCHOOL

LEPRECHAUN'S LUCK

Sabrina Fernandez and My Huynh (Grade 7)

SOUTH LAWRENCE EAST MIDDLE SCHOOL

CRACKING THE ZIP CODE

Michael Santos and Netra Yung (Grade 7)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

HENRY K. OLIVER SCHOOL, CONTINUED

IMMIGRANTS

Francis Victoria (Grade 8)

JAILER'S PROBLEM

Juan Dominguez (Grade 8)

MCAS SCORES

Susel Jerez (Grade 6)

MY EXTRAVAGANT SWEET 15

Melissa Duarte, Anakaren Guerrero, and Shakira Urena (Grade 7)

PATTERNS OF PASCAL

Victor Cepeda and Luis Miranda (Grade 8)

PLAYIN' WITH SAND

Mileiky Rodriguez (Grade 8)

PRIMES, SQUARES, AND FACTORS

Michelle Mercado (Grade 8)

A ROLL OF THE DICE

Julia Aquino (Grade 8)

SHAPE YOUR DATE

Hazel Lopez and Gisselle Madera (Grade 8)

SPORTS BAG

Yajania Villa (Grade 8)

TOWER OF HANOI

Desiree Bencosme and Duy Thao Nyugen (Grade 8)

TRADING PLACES

Angel Jimenez (Grade 8)

VIDEO DILEMMA

Marlenin Pena (Grade 8)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

LAWRENCE HIGH SCHOOL, CONTINUED

PROBABILITY AND COINS

Lucy Francisco, Ylvin Hiraldo, and Jonathan Torres (Grade 10)

THE BUFFON EXPERIMENT

Skaidy Mieses (Grade 9)

ARLINGTON MIDDLE SCHOOL

HOW MANY DIFFERENT CUBES CAN I MAKE?

Coral Sabino (Grade 6)

TESSELATIONS

Tariana Brito, Veraliz Perez, and Awilda Reynoso (Grade 8)

TV SHOWS

Masiel Guillermo, Francine Dume, and Zomayra Mendoza (Grade 8)

WHAT'S YOUR FAVORITE SPECIAL?

Shaun Carignan and Laureini Guerrero (Grade 5)

WHY COLLEGE IS IMPORTANT

Michelle Ramos and Jennirez Urbaez

ALEXANDER B. BRUCE SCHOOL

8TH GRADE HAIR COLOR

Erika Contreras, Evelyn Cumlo, and Mariana Morales (Grade 8)

GEOMETRIC SHAPES ARE EVERYWHERE!

Joan Disla, Mario Encarnacion, Joshua Morales (Grade 7)

GERARD A. GUILMETTE SCHOOL

AGE AND WEIGHT OF STUDENTS ON OTHER PLANETS AS COMPARED TO EARTH

Berioska Cardenas, Audrey Fernandez, and Sujehiry Hernandez (Grade 5)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

GERARD A. GUILMETTE SCHOOL, CONTINUED

AREA

Carolina Rodriguez and Crystal Romero (Grade 7)

THE CONSECUTIVE NUMBER PROBLEM

Shanice Brito and Louis Caraballo (Grade 8)

COST/SAVINGS

Olemny Caceres and Thania Gonzalez (Grade 7)

DIFFERENT ETHNICITIES IN GUILMETTE

Linoshka Berrios and Alexa Bilbraut (Grade 7)

A FAIR GAME?

Mery Rodriguez (Grade 8)

GOOGLE HITS

Alba Diaz and Johalisa Santana (Grade 5)

HOW LONG TO WALK, DRIVE, FLY TO DISNEY WORLD

Ninotchka Burgos (Grade 7)

HOW MUCH DO YOU WEIGH ON OTHER PLANETS?

Peter Guerrero, Karla Rivera, and Stephanie Rosales-Portillo (Grade 5)

LIFE EXPECTANCY IN THE PAST 100 YEARS

Melissa Delacruz and Idaliz Moreno (Grade 5)

MAZES

Jamilex Duran, Olimar Gonzalez, Monorum Pich Ty (Grade 5)

MOST POPULAR SNEAKERS IN 7TH GRADE

Yocayra Guzman and Yamely Moreno (Grade 7)

SPILT GLASS OF WATER

Mary Guzman and Yveliza Rodriguez (Grade 6)

WHO IS THE BEST PITCHER?

Ozzie Diaz and Luis Gonzalez (Grade 5)

LAWRENCE SCHOOL DISTRICT,

CONTINUED

GERARD A. GUILMETTE SCHOOL, CONTINUED

WNBA DRAFT

Issamar Herrera and Kelly Sicard (Grade 7)

FRANCIS M. LEAHY SCHOOL

GEOMETRIC SHAPES IN NATURE

Carina Anziani, Steven Collado, Rocherly Difo, Bladimir Nunez, Roberto Soto, and Arlines Torres (Grade 4)

MULTIPLICATION MADNESS

Juan Carvajal, Adrian Francisco, Kianna Medina, and Deshantee Rivera (Grade 5)

OPPOSITES ATTRACT

Freyleny Abreu, Jeremy Bello, Marianne Caceres, Chabeli Gonzalez, Milcy Perez, David Sanchez, and Jennifer Vargas (Grade 4)

PASCAL'S PATTERNS

Kelvin Aguirre, Paola Castro, and Ashley Rodriguez (Grade 5)

SEE HOW WE GROW

Anthony Abarca, Israel Anthony, Carlos Carela, Kimberly Cruz, Taina Pagan, and Julio Vincente (Grade 4)

SUM FACTS

Danny Adames, Kaira Bard, Mirka Rojas, and Robert White (Grade 5)

HENRY K. OLIVER SCHOOL

3-D VOLUME

Layda Soto (Grade 6)

CANDY SURVEY

Joharis Delossantos (Grade 5)

I SCREAM, YOU SCREAM...

Maria Gonzalez (Grade 8)
