

Bay Area Circle for Teacher - August 4-8, 2008

Resources Recommended by Speakers & Participants

Websites

National Association of Math Circles <http://mathcircles.org>

Art of Problem Solving <http://www.artofproblemsolving.com/>
Bay Area Forum: <http://www.artofproblemsolving.com/Forum/>

Tom Davis's Math Circle Lessons website <http://geometer.org/mathcircles/>

RecMath: Archive of Recreation Mathematics <http://recmath.org/>

Terence Tao <http://www.math.ucla.edu/~tao/> - young UCLA research mathematician who writes an articulate & accessible math blog.

Student Competitions

Julia Robinson Mathematics Festival <http://www.msri.org/specials/festival/index.html>

This is both an online competition & a day long event in the Bay Area! Problems will be available on the website starting mid-September.

Bay Area Math Olympiad (BAMO) <http://www.bamo.org/>

American Mathematics Competitions (AMC) <http://www.unl.edu/amc/index.shtml>

- AMC 8 Registration – November 18, 2008. <http://www.unl.edu/amc/e-exams/e4-amc08/amc8.shtml>
You can order a Math Club package of exams
- AMC 10 Registration – February 10 & 25, 2009 <http://www.unl.edu/amc/e-exams/e5-amc10/amc10.shtml>
- AMC 12 Registration – February 10 & 25, 2009 <http://www.unl.edu/amc/e-exams/e6-amc12/amc12.shtml>

Math Olympiads for Elementary and Middle Schools <http://www.moems.org/>

Math Counts <http://mathcounts.org/>

MATHCOUNTS is the premier middle school competition in the United States. More than 500,000 students participate annually at some level of the competition, making it one of the most extensive math programs in existence. Problems selected for Mathcounts competitions cover a wide range of material and are designed to challenge middle school students of all levels.

American Regions Mathematics League(ARML) <http://www.arml.com/index.php>

ARML consists of 15-person teams representing schools, cities, counties, or states at three locations in the US. The competition is team-oriented and very challenging, with a focus on problem solving and some mathematical writing.

USA Mathematical Talent Search (USAMTS) <http://www.usamts.org/>

A free mathematics competition open to all United States middle and high school students. As opposed to most mathematics competitions, the USAMTS allows students a full month to work out their solutions. Carefully written justifications are required for each problem. The problems range in difficulty from being within the reach of most high school students to challenging the best students in the nation. Students may use any materials - books, calculators, computers - but all the work must be their own. The USAMTS is run on the honor system - it is an individual competition, whose competitive role is very secondary. (Although we do give prizes.)

iTest <http://www.theitest.com/>

The iTest is a free online mathematics competition for high school students throughout the United States and abroad.

Mandelbrot <http://www.mandelbrot.org/>

The Mandelbrot Competition introduces high school students to accessible new topics in mathematics while providing stimulating, challenging problems. The team test portion of the contest emphasizes mathematical writing skills and effective group work.

Harvard-MIT Mathematics Tournament (HMMT) <http://web.mit.edu/hmmt/www/>

An annual math tournament for high school students, held at MIT and at Harvard in alternate years.

Books

Art of Problem Solving http://www.artofproblemsolving.com/Books/AoPS_B_Texts.php

Martin Gardner Math Books <http://www.g4g4.com/books.html>

The Book of Numbers By John Horton Conway, Richard K. Guy.

Description: In THE BOOK OF NUMBERS, two famous mathematicians fascinated by beautiful and intriguing number patterns share their insights and discoveries with each other and with readers. John Conway is the showman, master of mathematical games and flamboyant presentations; Richard Guy is the encyclopedist, always on top of problems waiting to be solved. Together they show us why patterns and properties of numbers have captivated mathematicians and non-mathematicians alike for centuries. THE BOOK OF NUMBERS features Conway and Guy's favorite stories about all the kinds of numbers any of us is likely to encounter, and many others besides. "Our aim," the authors write, "is to bring to the inquisitive reader. . . an explanation of the many ways the word 'number' is used." They explore patterns that emerge in arithmetic, algebra, and geometry, describe these pattern' relevance both inside and outside mathematics, and introduce the strange worlds of complex, transcendental, and surreal numbers. This unique book brings together facts, pictures and stories about numbers in a way that no one but an extraordinarily talented pair of mathematician/writers could do. - <http://books.google.com/>

Subjects: Number theory/ Popular works, Mathematics / Number Systems, Mathematics / Number Theory

The Magic of Numbers By Benedict H. Gross, Joe Harris

Description: A math book for "non-math" people, this book—based on a popular course at Harvard University—communicates to readers some idea of the mathematical view of world, and what attracts people to math in the first place. It uses a sense of humor and lighthearted tone to give learners a positive, enjoyable experience of thinking in math, and an understanding of the increasingly important role that science and technology play in our lives. A four-part format presents readers with a fundamental introduction, shows how they can think about arithmetic in a new way—based on what they already know, introduces them to truly abstract mathematics, and teaches them about the special properties of modular arithmetic that are central to modern life. For anyone who has taken an algebra class in high school, and wants to take their understanding of math a little farther—and into everyday life. - <http://books.google.com/>

Subjects: Mathematics, Mathematics / General, Mathematics / Arithmetic

A Friendly Introduction to Number Theory By Joseph H. Silverman, <http://www.math.brown.edu/~jhs/frint.html>

Description: A Friendly Introduction to Number Theory is an introductory undergraduate text designed to entice non-math majors into learning some mathematics, while at the same time teaching them how to think mathematically. The exposition is informal, with a wealth of numerical examples that are analyzed for patterns and used to make conjectures. Only then are theorems proved, with the emphasis on methods of proof rather than on specific results. Starting with nothing more than basic high school algebra, the reader is gradually led to the point of producing their own conjectures and proofs, as well as getting some glimpses at the frontiers of current mathematical research.

Matters mathematical By I. N. Herstein, Irving Kaplansky

From the Preface: "This book is based on notes prepared for a course at the University of Chicago. The course was intended for nonmajors whose mathematical training was somewhat limited ... Mastery of the material requires nothing beyond algebra and geometry normally covered in high school ... [It] could be used in courses designed for students who intend to teach mathematics ... We want the reader to see mathematics as a living subject in which new results are constantly being obtained."

Subjects: Mathematics, Mathematics / General

Challenging problems in geometry By Alfred S. Posamentier, Charles T. Salkind

Description: Stimulating collection of unusual problems dealing with congruence and parallelism, the Pythagorean theorem, circles, area relationships, Ptolemy and the cyclic quadrilateral, collinearity and concurrency and many other topics. Arranged in order of difficulty. Detailed solutions.

Subjects: Geometry/ Problems, exercises, etc, Mathematics / Geometry / General, Mathematics / General

The Art of the Infinite By Robert Kaplan, Ellen Kaplan

Description: In this delightful new book, Robert Kaplan, writing together with his wife Ellen Kaplan, once again takes us on a witty, literate, and accessible tour of the world of mathematics. Where The Nothing That Is looked at math through the lens of zero, The Art of the Infinite takes infinity, in its countless guises, as a touchstone for understanding mathematical thinking. Tracing a path from Pythagoras, whose great Theorem led inexorably to a discovery that his followers tried in vain to keep secret (the existence of irrational numbers); through Descartes and Leibniz; to the brilliant, haunted Georg Cantor, who proved that infinity can come in different sizes, the Kaplans show how the attempt to grasp the ungraspable embodies the essence of mathematics. The Kaplans guide us through

the “Republic of Numbers,” where we meet both its upstanding citizens and more shadowy dwellers; and we travel across the plane of geometry into the unlikely realm where parallel lines meet. Along the way, deft character studies of great mathematicians (and equally colorful lesser ones) illustrate the opposed yet intertwined modes of mathematical thinking: the intuitionist notion that we discover mathematical truth as it exists, and the formalist belief that math is true because we invent consistent rules for it.

Subjects: Series, Infinite, Processes, Infinite, Mathematics / Infinity

The Nothing that Is By Robert Kaplan, Ellen Kaplan

A symbol for what is not there, an emptiness that increases any number it’s added to, an inexhaustible and indispensable paradox. As we welcome the new millennium, zero is once again making its presence felt. Nothing itself, it makes possible a myriad of calculations. Indeed, without zero mathematics as we know it would not exist. And without mathematics our understanding of the universe would be vastly impoverished. But where did this nothing, this hollow circle, come from? Who created it? And what, exactly, does it mean?

Robert Kaplan’s *The Nothing That Is: A Natural History of Zero* begins as a mystery story, taking us back to Sumerian times, then to Greece and India, piecing together the way the idea of a symbol for nothing evolved. For Kaplan, the history of zero is a lens for looking not only into the evolution of mathematics but into very nature of human thought. He points out how the history of mathematics is a process of recursive abstraction: how once a symbol is created to represent an idea, that symbol itself gives rise to new operations that in turn lead to new ideas. The beauty of mathematics is that even though we invent it, we seem to be discovering something that already exists.

The joy of that discovery shines from Kaplan’s pages, as he ranges from Archimedes to Einstein, making fascinating connections between mathematical insights from every age and culture.

Subjects: Zero (The number), Mathematics / History & Philosophy, Science / Philosophy & Social Aspects

Mathematical Puzzles By Peter Winkler

Description: This collection includes more than 100 of the best (and some of the toughest) mathematical puzzles ever to appear in one volume.

Subjects: Mathematical recreations, Mathematics / Recreations & Games

Solving Mathematical Problems: A Personal Perspective By Terence Tao

Description: Authored by a leading name in mathematics, this engaging and clearly presented text leads the reader through the various tactics involved in solving mathematical problems at the Mathematical Olympiad level. Covering number theory, algebra, analysis, Euclidean geometry, and analytic geometry, *Solving Mathematical Problems* includes numerous exercises and model solutions throughout. Assuming only a basic level of mathematics, the text is ideal for students of 14 years and above in pure mathematics.

How to Solve it: A New Aspect of Mathematical Method By G. Polya, John Horton Conway

Description: A perennial bestseller by eminent mathematician G. Polya, *How to Solve It* will show anyone in any field how to think straight.

In lucid and appealing prose, Polya reveals how the mathematical method of demonstrating a proof or finding an unknown can be of help in attacking any problem that can be “reasoned” out—from building a bridge to winning a game of anagrams. Generations of readers have relished Polya’s deft—indeed, brilliant—instructions on stripping away irrelevancies and going straight to the heart of the problem.

Subjects: Mathematics, Mathematics / Logic, Mathematics / Applied

The Heart of Mathematics: An Invitation to Effective Thinking by Edward B. Burger (Author), Michael Starbird (Author)

Description: *The Heart of Mathematics* addresses the big ideas of mathematics (many of which are cutting edge research topics) in a non-computational style intended to be both read and enjoyed by students and instructors, as well as by motivated general readers. It features an engaging, lively, humorous style full of surprises, games, mind-benders, and all without either sacrificing good mathematical thought or relying on mathematical computation or symbols. The authors are award-winning authors, holding awards such as: Distinguished Teaching Award (Burger, from the Mathematical Association of America); Chauvenet Prize (the best expository mathematics writer in the world, Burger, from the MAA) and many others.

Subjects: Mathematics, Mathematics / General

Blue Balliett Series <http://www.scholastic.com/blueballiett/chasingvermeer.htm>

Chasing Vermeer, released by Scholastic Press in 2004, is the best known and most highly praised book. Illustrated by Brett Helquist, it is about the fictitious theft of a Johannes Vermeer painting. It was a bestseller and won a number of

accolades and awards, including the 2005 Edgar Award in the Best Juvenile category, and it was optioned by Warner Brothers for a film version. A second book, *The Wright 3*, was released in April 2006 as a sequel, and a third, *The Calder Game*, was released two years later, in April 2008. She has also written two books of Nantucket ghost stories. - recommended for the website activities that accompany it.

DVD's

The Joy of Thinking: The Beauty and Power of Classical Mathematical Ideas Great Courses Parts I and II Teaching Company Starring: Michael Starbird, Edward B Burger

Flatland <http://store.flatlandthemovie.com/>

Julia Robinson and Hilbert's Tenth Problem

Hard Problems: The Road to the World's Toughest Math Contest <http://www.hardproblemsmovie.com/>