

Communicating Mathematics

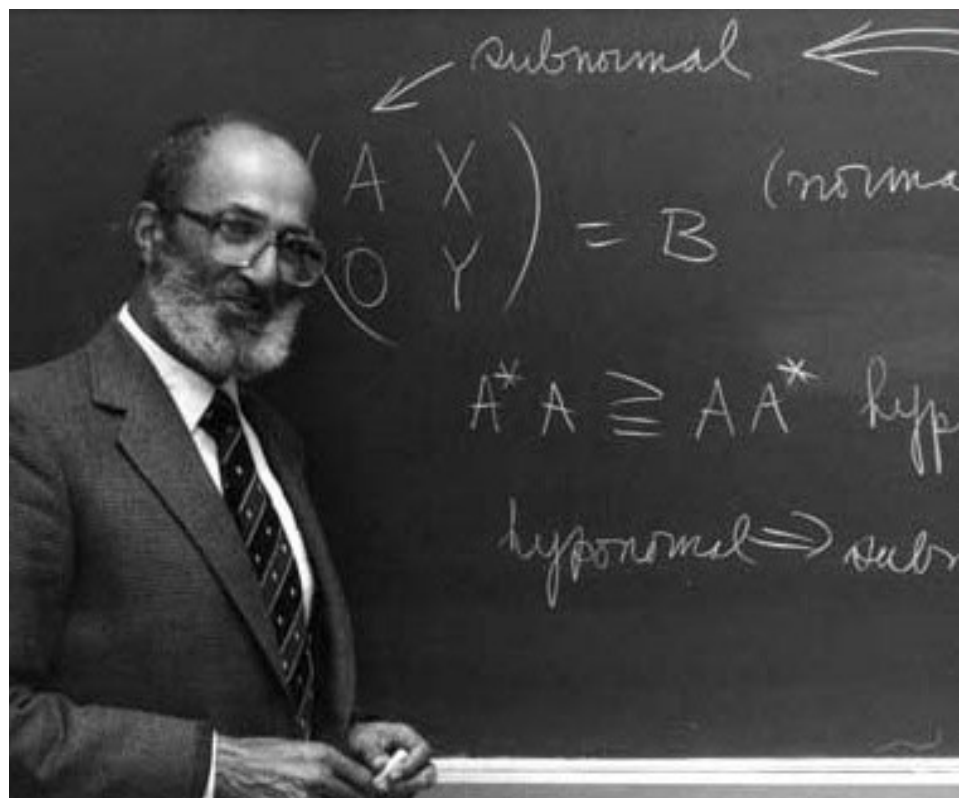
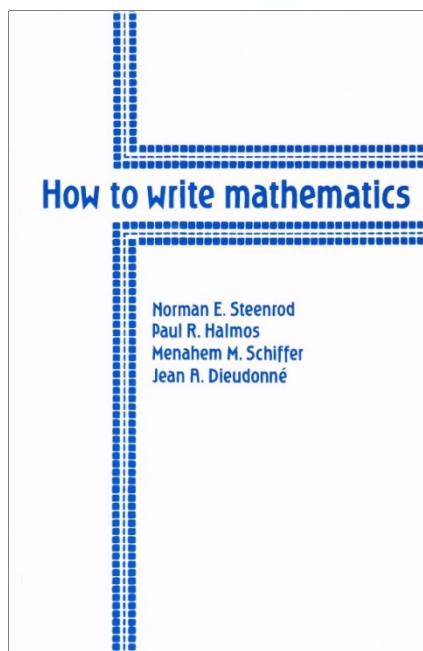
Ivars Peterson

ipeterson@maa.org

ivarspeterson.googlepages.com

Communicating Mathematics

Paul R. Halmos in *How to Write Mathematics*, American Mathematical Society, 1973.



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"The basic problem in writing mathematics is the same as in writing biology, writing a novel, or writing directions for assembling a harpsichord: the problem is to communicate an idea.

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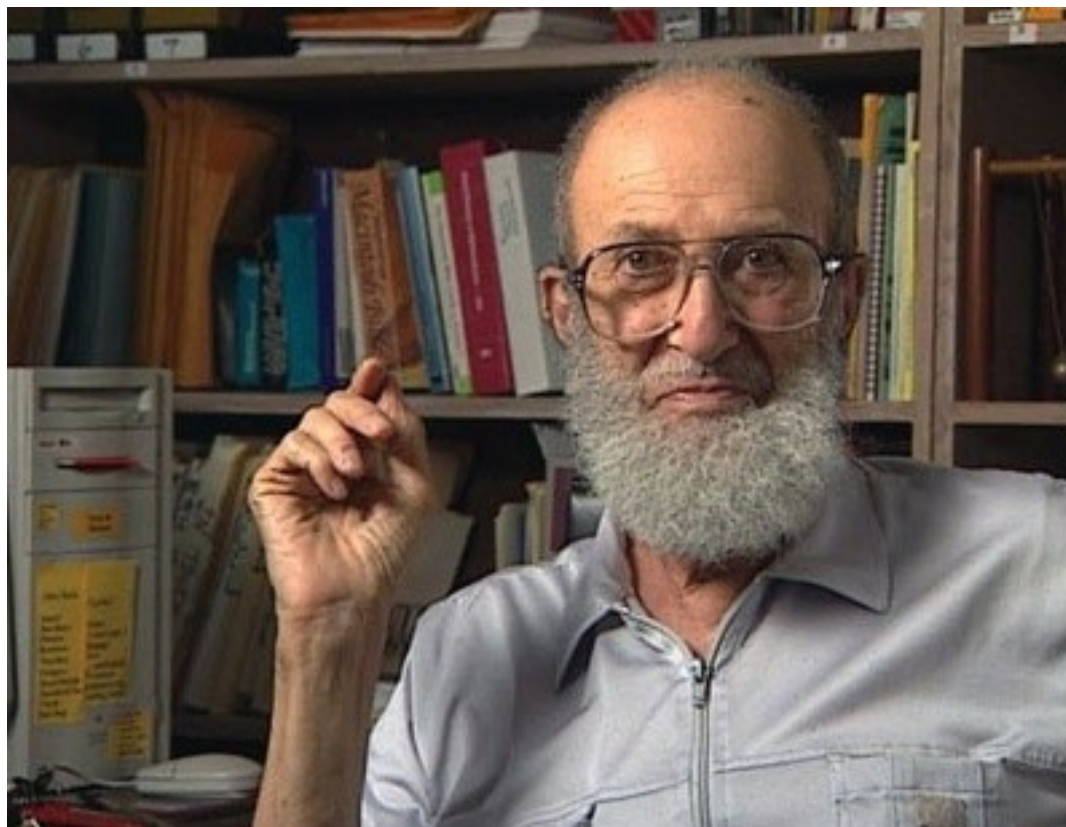
"To do so, and to do it clearly, you must have something to say, and you must have someone to say it to, you must organize what you want to say, and you must arrange it in the order that you want it said in . . .

Communicating Mathematics

". . . you must write it, rewrite it, and re-rewrite it several times, and you must be willing to think hard about and work hard on mechanical details such as diction, notation, and punctuation.

Communicating Mathematics

"That's all there is to it."



Communicating Mathematics

"To do so, and to do it clearly, **you must have something to say**, and you must have someone to say it to, you must organize what you want to say, and you must arrange it in the order that you want it said in . . .

Communicating Mathematics

Leslie Lamport, Microsoft Research

“You should be excited about what you are writing, and that excitement should show.”

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we have $f \circ \sigma \neq f$. If $M(n, k)$ is the number of these and $F(n, k)$ is the number of orbits of mappings f under the action of C_n , then evidently

$$F(n, k) = \sum_{d|n} M(d, k) \quad (n \geq 1) \quad (1)$$

But since, clearly,

$$\sum_{d|n} dM(d, k) = k^n \quad (n \geq 1) \quad (2)$$

we find from (2),

$$M(n, k) = \frac{1}{n} \sum_{d|n} \mu(n/d) k^d$$

Mathematical Writing

Donald E. Knuth
Tracy Larrabee
Paul M. Roberts

✓ Insert semicolon	Capitalization (margin indication)	Transpose (margin indication)
✓ Insert apostrophe	Set indicated in small capitals	Start new paragraph
✓ Insert exclamation mark or exclamation point	Small capitals (margin indication)	Paragraph (margin indication)
✓ Insert question mark or interrogation point	Set indicated material in capitals and small capitals	No paragraph - run ind material together
En dash	Capitals and small capitals (margin indication)	No paragraph (margin indication)
One-em dash	Set indicated material in italics	Query to author
Two-em dash	Italics (margin indication)	Delete indicated material (vertical or horizontal line through material)
Parentheses	Change to roman	Delete or take out (margin indication)
Brackets	Caret	Take out characters and close up
Insert quotation marks (double)	Insert space	Close up
Insert quotation marks (single)	Equalize space or space evenly	Transfer encircled material
Brace or pair of braces	Insert hair space	
Raise	Letterspace	
Lower		
Align horizontally		
Stretch vertically		

MAA Notes Number 14 The Mathematical Association of America

Communicating Mathematics

"To do so, and to do it clearly, you must have something to say, and **you must have someone to say it to**, you must organize what you want to say, and you must arrange it in the order that you want it said in . . .

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Picture your reader. **Know your audience.**

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MAA FOCUS | April/May 2009

Knowing What it Means to “Know Your Audience”

Aaron Luttmann and Rachel Schwell

Communicating Mathematics

“Knowing your audience” is a two-sided coin. The first (and obvious) part is identifying the actual audience and their mathematical background. The second, which our graduate student skipped completely, is *formulating a story that is captivating for those listeners*. Rather than asking, “What do I find interesting about my topic?” the presenter should instead ask, “What will my audience find interesting about this topic?”

Communicating Mathematics

Leslie Lamport, Microsoft Research

<http://research.microsoft.com/users/lamport/pubs/pubs.html>

“We must keep in mind what we are writing—and to whom.”

Communicating Mathematics

Herbert Wilf

Get the attention of your readers immediately. Use snappy titles, arresting first sentences, and lucid initial paragraphs.

Communicating Mathematics

Leonard Gillman

Keep your title short and include key words to make it informative.

Communicating Mathematics

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Keep your title short and include key words to make it informative.

A long title sounds pompous and is a nuisance to refer to.

Communicating Mathematics

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Keep your title short and include key words to make it informative.

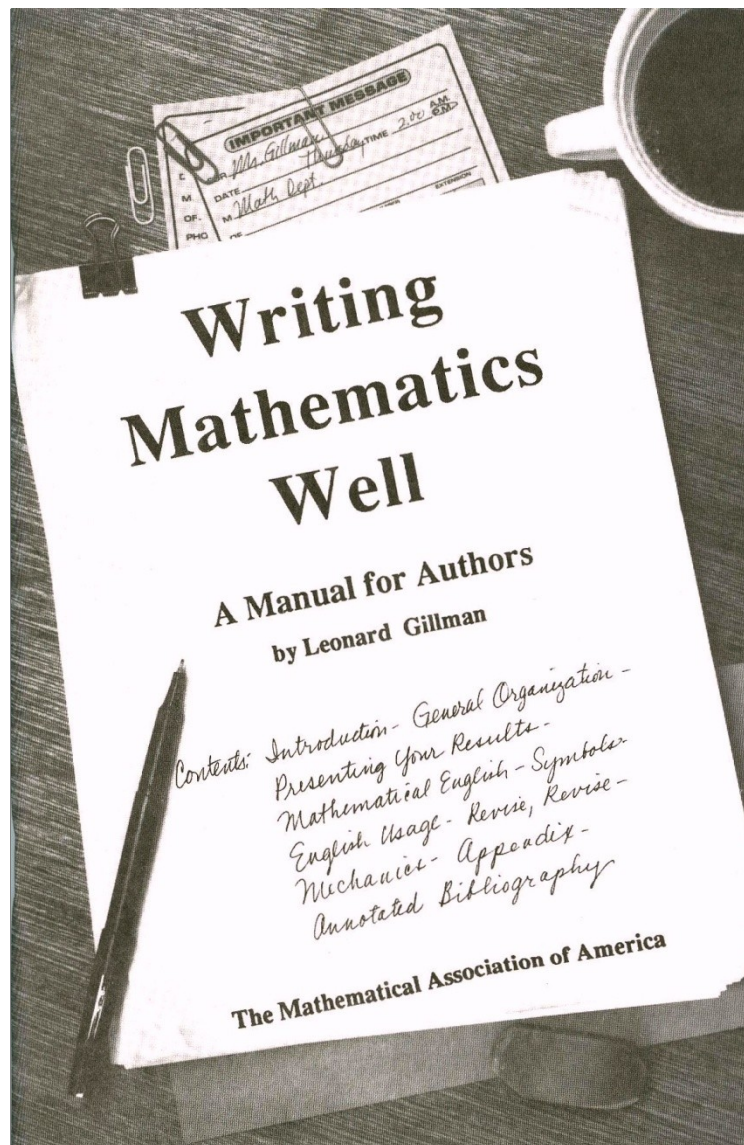
A long title sounds pompous and is a nuisance to refer to.

Steer clear of symbols.

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**“To a Factor *près*”: Cayley’s Partial
Anticipation of the Weierstrass \wp -Function**

Communicating Mathematics



Communicating Mathematics

The first sentence matters. **You need to begin your article in a way that pulls in the reader.**

Communicating Mathematics

Herbert Wilf

1. Get the attention of your readers immediately. Use snappy titles, arresting first sentences, and lucid initial paragraphs.
2. **Get everything up front. Tell your readers in plain English what you are going to write about.**

Communicating Mathematics

Leonard Gillman

The first paragraph of the introduction
should be comprehensible to any
mathematician.

Communicating Mathematics

Leonard Gillman

The first paragraph of the introduction should be comprehensible to any mathematician.

Describe in general terms what the paper is about; and do it in a way that entices the reader to continue reading.

Communicating Mathematics

Leonard Gillman

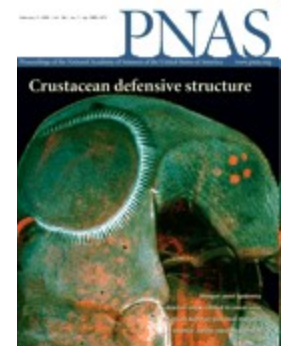
The first paragraph of the introduction should be comprehensible to any mathematician.

Settle for a rough statement in words;
eschew a precise statement loaded with
symbols and technical terms.

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Let A be a k -bialgebra with multiplication μ and comultiplication Δ . We write $A \dots$

Communicating Mathematics



Communicating Mathematics

Let A be a k -bialgebra with multiplication μ and comultiplication Δ . We write $A \dots$

Abstract: We introduce cohomology and deformation theories for a bialgebra A (over a commutative unital ring k) such that the second cohomology group is the space of infinitesimal deformations.

Communicating Mathematics

Abstract: We introduce cohomology and deformation theories for a bialgebra A (over a commutative unital ring k) such that the second cohomology group is the space of infinitesimal deformations.

Title: Bialgebra cohomology, deformations, and quantum groups.

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Abstract: Eighty years ago, Ramanujan conjectured and proved some striking congruences for the partition function modulo powers of 5, 7, and 11.

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Abstract: Eighty years ago, Ramanujan conjectured and proved some striking congruences for the partition function modulo powers of 5, 7, and 11. **Until recently, only a handful of further such congruences were known.**

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Abstract: Here we report that such congruences are much more widespread than was previously known, and we describe the theoretical framework that appears to explain every known Ramanujan-type congruence.

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Let $p(n)$ denote the usual partition function;
 $p(n)$ is the number of ways to write a
positive integer n as the sum of a
nonincreasing sequence of positive
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Title: Congruence properties for the partition
function

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Let $p(n)$ denote the usual partition function;
 $p(n)$ is the number of ways to write a
positive integer n as the sum of a
nonincreasing sequence of positive
integers.

Title: Congruence properties for the partition
function

Authors: Scott Ahlgren and Ken Ono

Communicating Mathematics

Title: Partition congruences and the
Andrews-Garvan-Dyson crank

Author: Karl Mahlburg

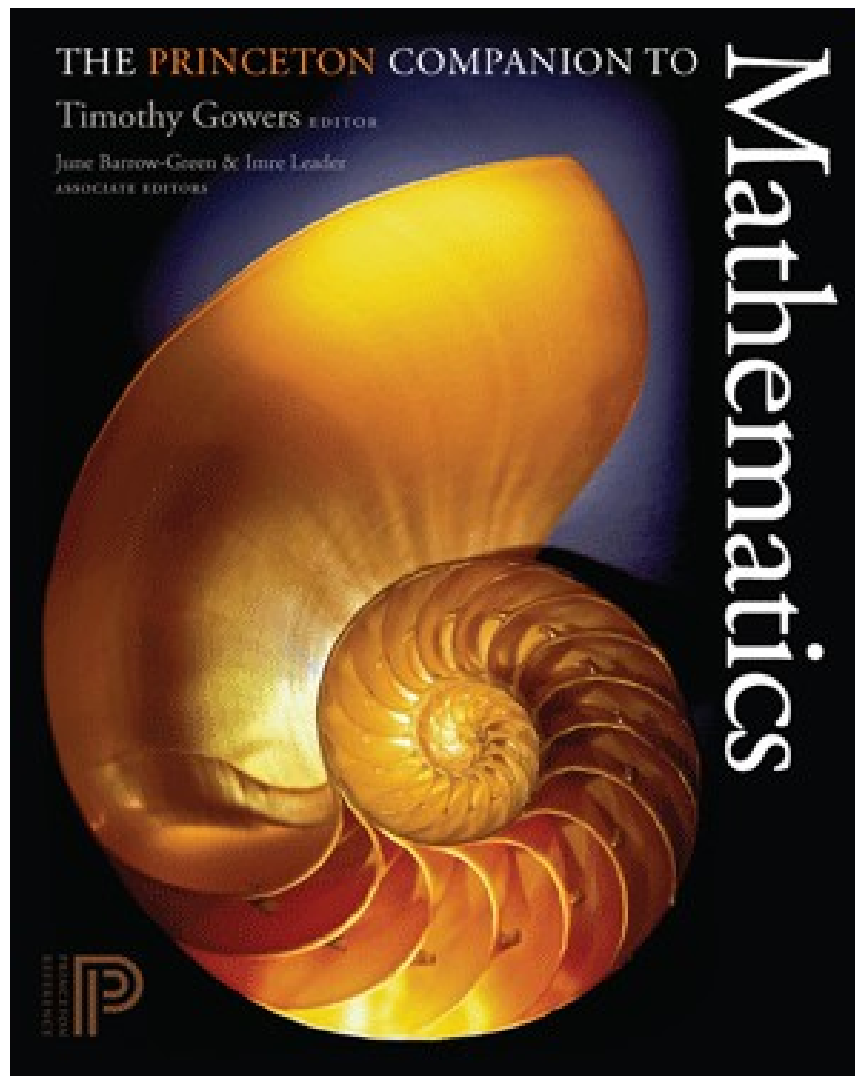
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Abstract: In 1944, Freeman Dyson conjectured the existence of a “crank” function for partitions that would provide a combinatorial proof of Ramanujan's congruence modulo 11. Forty years later, Andrews and Garvan successfully found such a function and proved the celebrated result that the crank simultaneously “explains” the three Ramanujan congruences modulo 5, 7, and 11. This note announces the proof of a conjecture of Ono, which essentially asserts that the elusive crank satisfies exactly the same types of general congruences as the partition function.

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In April 2006, **PNAS awarded its first Paper of the Year prize to Karl Mahlburg**, a mathematics graduate student studying with number theorist Ken Ono. . . . Mahlburg's work “adds a lustrous chapter,” as mathematician George E. Andrews said in a Commentary, to the study of a long-standing problem involving partition theory and the crank function—all of which began with an observation by the famed Indian mathematician Srinivasa Ramanujan in 1920.

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Fuchsian Groups—Jeremy Gray

- One of the most basic objects in geometry is the torus: a surface that has the shape of the surface of a bagel. If you want to construct one, you can do so by taking a square and gluing opposite edges together.

Communicating Mathematics

The Gamma Function—Ben Green

- If n is a positive integer, then its *factorial*, written $n!$, is the number $1 \times 2 \times \dots \times n$: that is, the product of all positive integers up to n . For example, the first eight factorials are 1, 2, 6, 24, 120, 720, 5040, and 40 320.

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The Gamma Function—Ben Green

- (The exclamation mark was introduced by Christian Kramp 200 years ago as a convenience to the printer: it is perhaps also intended to convey some alarm at the rapidity with which $n!$ grows. An obsolete notation, which can still be found in some twentieth-century texts, is $\lfloor n.$)

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The Gamma Function—Ben Green

- From this definition, it might appear to be impossible to make sense of the idea of the factorial of a number that is not a positive integer, but, as it turns out, it is not just possible to do so, but also extremely useful.

Communicating Mathematics

Hamiltonians—Terence Tao

- At first glance, the many theories and equations of modern physics exhibit a bewildering diversity: for instance, compare classical mechanics with quantum mechanics, or nonrelativistic physics with relativistic physics, or particle physics with statistical mechanics. However, there are strong unifying themes connecting all of these theories.

Communicating Mathematics

Hamiltonians—Terence Tao

- At first glance, the many theories and equations of modern physics exhibit a bewildering diversity: for instance, compare classical mechanics with quantum mechanics, or nonrelativistic physics with relativistic physics, or particle physics with statistical mechanics. **However, there are strong unifying themes connecting all of these theories.**

Communicating Mathematics

Hamiltonians—Terence Tao

- One of these is the remarkable fact that in all of them the evolution of a physical system over time (as well as the steady states of that system) is largely controlled by a single object, the *Hamiltonian* of that system, which can often be interpreted as describing the total energy of any given state in that system.

Communicating Mathematics

Hamiltonians—Terence Tao

- One of these is the remarkable fact that in all of them **the evolution of a physical system over time** (as well as the steady states of that system) **is largely controlled by a single object**, the *Hamiltonian* of that system, which can often be interpreted as describing the total energy of any given state in that system.

Communicating Mathematics

Arithmetic Geometry—Jordan S. Ellenberg

Our goal is to sketch some of the essential ideas of arithmetic geometry; we begin with a problem which, on the face of it, involves no geometry and only a bit of arithmetic.

Communicating Mathematics

Have a clear sense of your article and its structure before you begin writing.

Communicating Mathematics

Use transitions. **An article has to flow.**

Communicating Mathematics

“In science writing, where events proceed on logic, order counts. In each paragraph, the sentences have a right order; and in each sentence, the words have a right order; and all you have to do is find the order.”
—Ann Finkbeiner

A Field Guide for Science Writers, Chapter 4, pp. 26-33.

Communicating Mathematics

Leonard Gilman

Introduce one idea at a time.

Communicating Mathematics

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Introduce one idea at a time.

Make liberal use of examples, perhaps
suppressing the most abstract
formulation of the idea.

Communicating Mathematics

Leonard Gilman

Introduce one idea at a time.

Make liberal use of examples, perhaps
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formulation of the idea.

Link ideas to what you assume is familiar to
the reader.

Communicating Mathematics

Use analogies and examples.

Communicating Mathematics

Leslie Lamport, Microsoft Research

“It’s never a mistake to have too simple an example.”

Communicating Mathematics

Read your work out loud.

Workshop: Communicating Mathematics

Don't be shy. **Ask others to read your drafts. A dispassionate reader is a writer's best friend.**

Workshop: Communicating Mathematics

**Giving a Good Presentation
by
Joseph A. Gallian
University of Minnesota, Duluth**

<http://www.maa.org/students/presentation.pdf>

Workshop: Communicating Mathematics



A Guide to Writing an Abstract



The Mathematical Association of America

Life should be as simple as possible, but not one bit simpler.

Attributed to Albert Einstein

The same is true for abstracts....

<http://www.maa.org/students/writing%20abstracts.pdf>

Workshop: Communicating Mathematics

Don't overwrite. **Avoid clichés.**

Steven Krantz: “Each field of mathematics has its own set of stock phrases and tiresome clichés. Try not to use them.”

Communicating Mathematics

Don't overwrite. **Avoid clichés.**

Write in English. **Avoid jargon.**

JOHANNES KEPLER'S UPHILL BATTLE



Communicating Mathematics: Style

Overused Words

Obviously, Clearly, Trivially

Communicating Mathematics: Style

Overused Words

Obviously, Clearly, Trivially

Avoid using these words.

Obviously, the answer becomes more accurate as n approaches infinity . . .

Communicating Mathematics: Style

Overused Words

Obviously, Clearly, Trivially

Avoid using these words.

The claim follows **trivially** from Proposition 4 . . .

Communicating Mathematics: Style

Overused Words

Obviously, Clearly, Trivially

Avoid using these words.

Clearly, for every $k \geq 1$ there exists a point $x \dots$

Workshop: Communicating Mathematics

Don't overwrite. **Avoid clichés.**

Write in English. **Avoid jargon.**

Omit needless words.

Communicating Mathematics: Style

Put every word in every sentence under the microscope.

Communicating Mathematics: Style

Put every word in every sentence under the microscope:

What does it add to the sentence?

Communicating Mathematics: Style

Put every word in every sentence under the microscope:

What does it add to the sentence?

Will the sentence lose its meaning if the word is omitted?

Communicating Mathematics: Style

Put every word in every sentence under the microscope:

What does it add to the sentence?

Will the sentence lose its meaning if the word is omitted?

Can the thought be expressed in fewer words?



International Congress of Mathematicians

19-27 August, 2010, Hyderabad



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Communicating Mathematics to Society at Large



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Christiane Rousseau: The Importance of the Message

- **The message should be scientifically (mathematically) significant.**

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Christiane Rousseau: The Importance of the Message

- The message should be scientifically (mathematically) significant.
- **It must be well illustrated.**

Communicating Mathematics

Christiane Rousseau: The Importance of the Message

- The message should be scientifically (mathematically) significant.
- It must be well illustrated.
- The message should be delivered at multiple levels.

The Klein Project

www.kleinproject.org

Navigation

- Hauptseite
- Letzte Änderungen
- Hilfe

Suche

Seite Suchen

Ads by Google

Nysmith School for Gifted
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Nysmith.com

The Klein Project

International Mathematical Union (IMU)


International Commission on Mathematical Instruction

Mathematics for Upper Secondary Teachers

In 2008 IMU and ICMI commissioned a project to revisit the intent of Felix Klein when he wrote *Elementary Mathematics from an Advanced Standpoint* one hundred years earlier. The aim is to produce a book for upper secondary teachers that communicates the breadth and vitality of the research discipline of mathematics and connects it to the senior secondary school curriculum. The 300-page book, prepared in more than 10 languages, will be written to inspire teachers to present to their students a more informed picture of the growing and interconnected field represented by the mathematical sciences in today's world. We expect this will be backed up by web, print, and DVD resources. For more information see More Information below.

The international Design Group for the project met first in Paris in May 2009, and again in Auckland in April, 2010. The project is expected to take about four years.

The book cannot be either comprehensive, nor definitive of the field. The text will emphasise links between branches of the field and generic themes (such as the impact of computing). Insights from mathematics education will not be addressed specifically but will be implicit in many places.



Die Grundformen der
mathematischen Wissenschaften in Einzeldarstellungen
Band 14

F. Klein

Elementarmathematik
vom höheren Standpunkte aus
I

start

Talks-ICM

Microsoft PowerPoint ...

ICM-PANEL.pdf - Ado...

The Klein Project - Go...

2:28 PM

<http://www.kleinproject.org/>

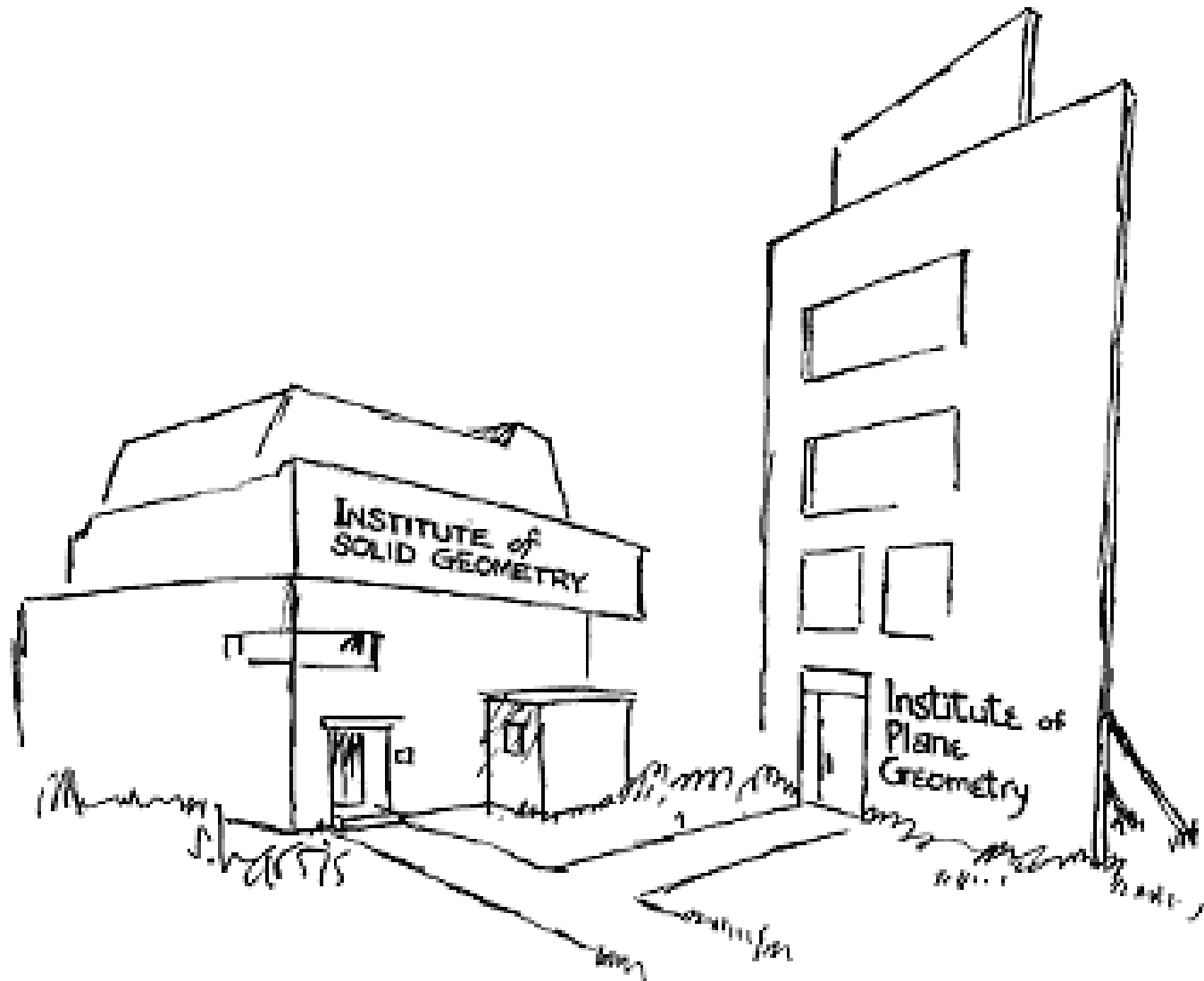
Communicating Mathematics

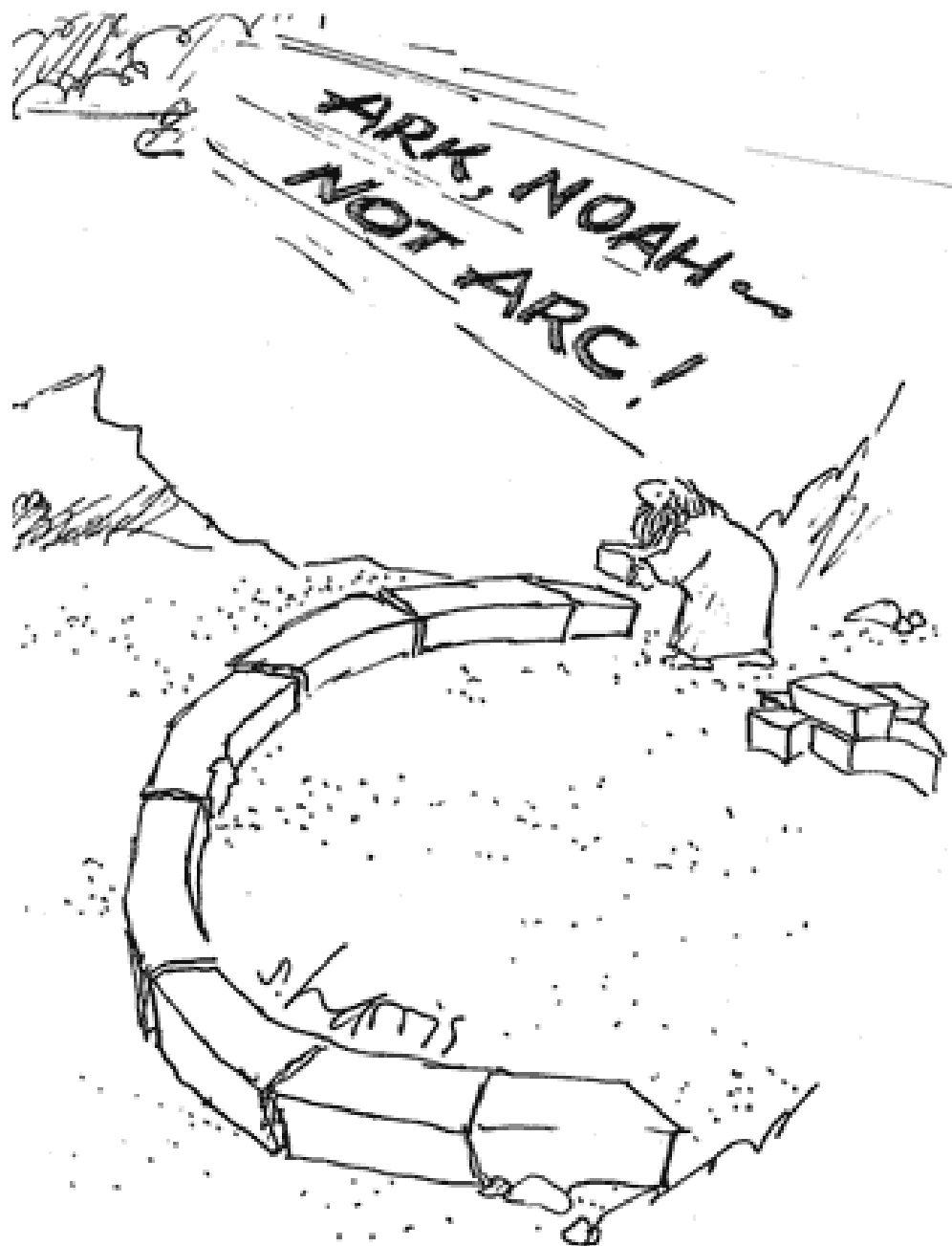
The book will be written to inspire teachers to present to their students a more informed picture of the growing and interconnected field represented by the mathematical sciences in today's world.

**Mathematics is a (universally
shared) language.**

**Symbols, words,
visualizations.**

Communicating Mathematics:





Communicating Mathematics: The Words of Mathematics

function

Communicating Mathematics: The Words of Mathematics

function

*The American Heritage Dictionary of the
English Language*

Communicating Mathematics: The Words of Mathematics

function

1. The action for which a person or thing is particularly fitted or employed.
2.
 - a. Assigned duty of activity.
 - b. A specific occupation or role:
in my function as chief editor.
3. An official ceremony or a formal social occasion.
4. Something closely related to another thing and dependent on it for existence, value, or significance.
Growth is a function of nutrition.

Communicating Mathematics: The Words of Mathematics

function

5. Mathematics

a. A variable so related to another that for each value assumed by one there is a value determined for the other.

b. A rule of correspondence between two sets such that there is a unique element in the second set assigned to each element of the first set.

Communicating Mathematics: The Words of Mathematics

function

6. *Biology* The physiological activity of an organ or body part.
7. *Chemistry* The characteristic behavior of a chemical compound, resulting from the presence of a specific functional group.
8. *Computer Science* A procedure within an application.

Communicating Mathematics: The Words of Mathematics

Acute	Base	Chaos	Chord
Composite	Concurrent	Coordinate	Degree
Dimension	Domain	Exponent	Factor
Graph	Group	Linear	Matrix
Mean	Network	Obtuse	Order
Power	Prism	Proof	Radical
Range	Relation	Root	Series
Set	Vector	Volume	

A horizontal banner with a teal background. On the left, there is a purple rounded rectangle containing the text '+ plus' in white, with 'magazine' in smaller yellow text below it. To the right of this, the text '...living mathematics' is written in a light, italicized font. The background of the banner features faint, stylized mathematical diagrams, including a dodecahedron and various geometric shapes.

+ plus
magazine

...living
mathematics

Marianne Freiberger
Plus Magazine
Millennium Mathematics Project

- Plus is a free online magazine about all aspects of mathematics, from the Riemann Hypothesis to DNA sequencing
- Plus is part of the Millennium Mathematics Project (<http://mmp.maths.org>) based at the University of Cambridge
- Plus is aimed at an adult (15+) audience with high school level understanding of mathematics
- Plus contains in-depth articles written by mathematicians, scientists and other experts, news stories, podcasts, careers library

How to make a perfect plane



Two lines in a plane always intersect in a single point ... unless the lines are parallel. This...

VICKI

Do you know what's good for you?



Understand the maths behind health and medicine. Read the latest and join the debate!

VICKI

It's a match!



"It's a match!" cries the CSI. At first glance it might seem that if the police

<http://plus.maths.org>

Hands-on maths: Mysterious number 6174 by Yutaka Nishiyama

Exploring Kaprekar's operation. All time Plus favourite. 80,000 page views in a single day, over 320,000 page views in total.

"I hate math, but love this kind of stuff."

A mathematical journey: The story of the Gömböc based on interview with Gábor Domokos

Proving the existence of a 3D convex homogeneous shape with one stable and one unstable equilibrium point. 33,000 page views in a single day, 133,000 in total.



Maths by stealth: Swimming in mathematics by Rachel Thomas

The maths of the Water Cube, Beijing Olympics aquatic venue, based on the Weaire-Phelan structure. Drew in a wide audience of people not primarily interested in mathematics.

Günter M. Ziegler

Mathematics Media Office

German Mathematical Society (DMV)

`ziegler@math.tu-berlin.de`

“The Setting, the Occasions”

The Year of Mathematics 2008

Wissenschaftsjahr

2008

Mathematik
Alles, was zählt

Communicating Mathematics

1. Mathematics is multifaceted.

Communicating Mathematics

- 1. Mathematics is multifaceted.**
- 2. Math is difficult.**

Communicating Mathematics

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- 2. Math is difficult.**
- 3. Don't try to teach.**

Communicating Mathematics

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- 4. Images, colors, graphics, photos are important.**

Communicating Mathematics

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- 5. People are important.**

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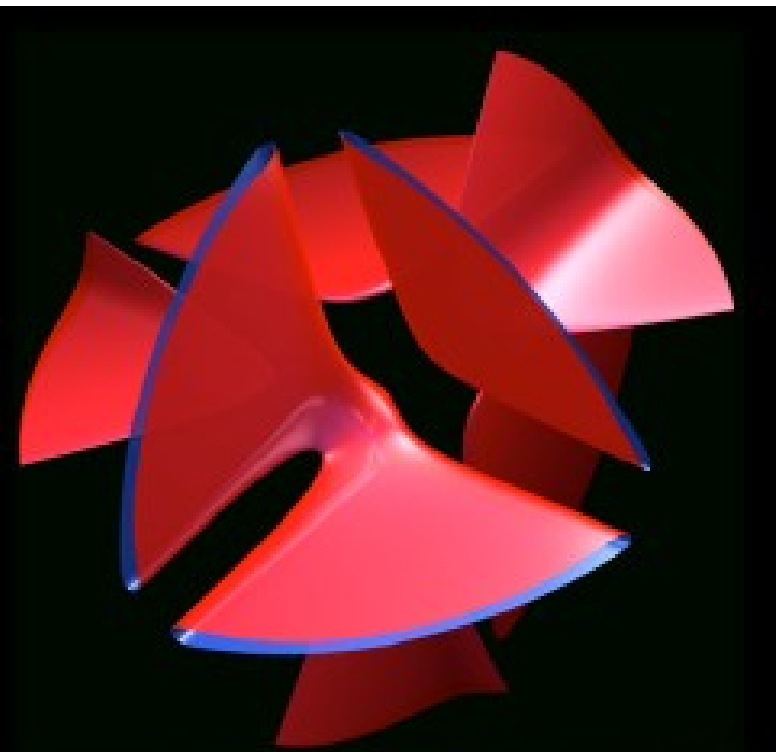
- 1. Mathematics is multifaceted.**
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- 6. Talk to the press.**

Communicating Mathematics

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- 7. Use professionals.**

Communicating Mathematics

- 1. Mathematics is multifaceted.**
- 2. Math is difficult.**
- 3. Don't try to teach.**
- 4. Images, colors, graphics, photos are important.**
- 5. People are important.**
- 6. Talk to the press.**
- 7. Use professionals.**
- 8. Make it a community effort.**



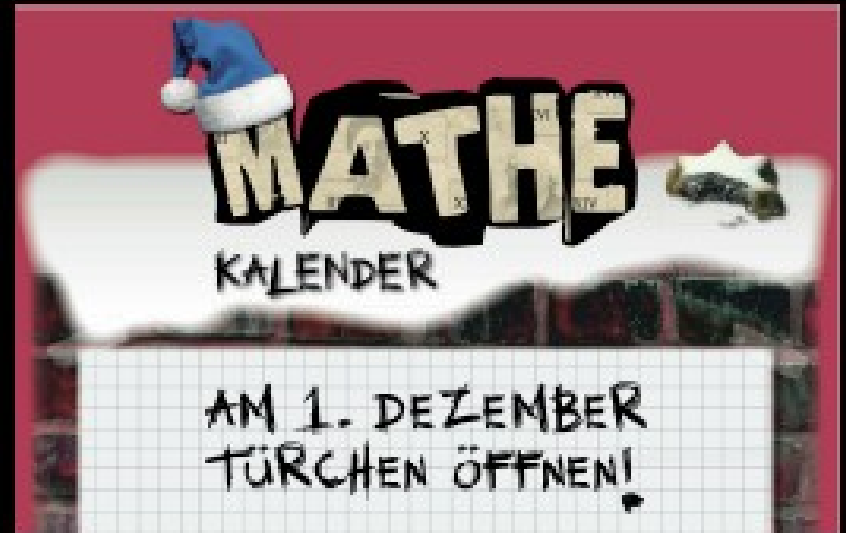
Extra problem 2: Tricky problem

What **** * * ****, ** * * * N , * * * * *
**** ?

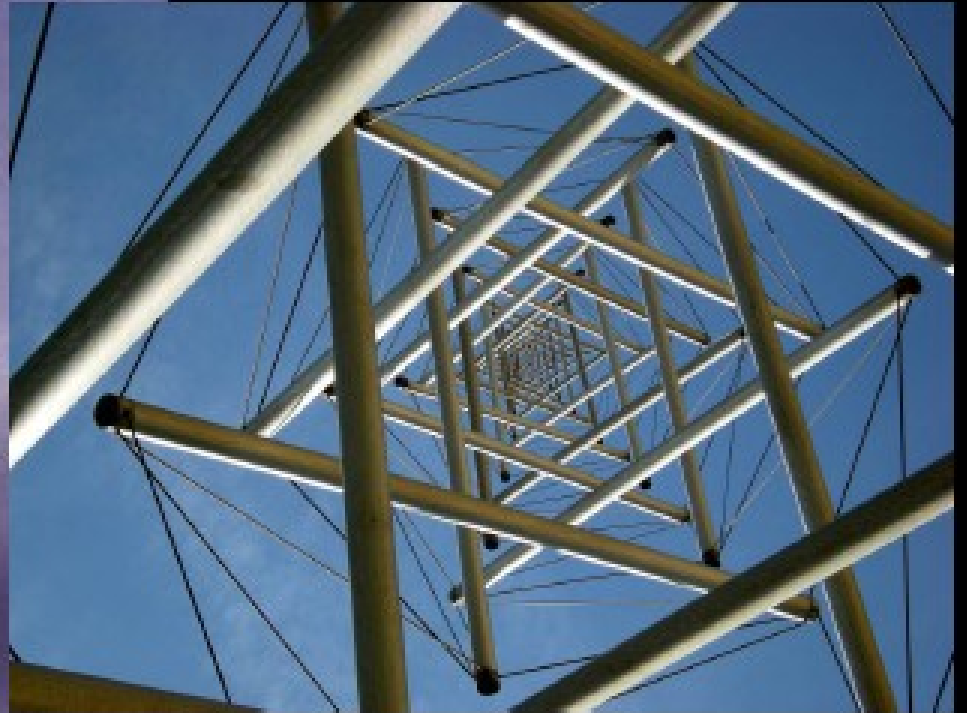


A. N is divisible by 6	B. N is a prime number between 20 und 25
C. $N = 23$	D. $N = 42$





Needle Tower
Kenneth Snelson



Mathematics Awareness Month - April 2010

Mathematics and Sports

Why can she bend
it like Beckham?

Mathematics can answer this
question and many others.
www.mathaware.org



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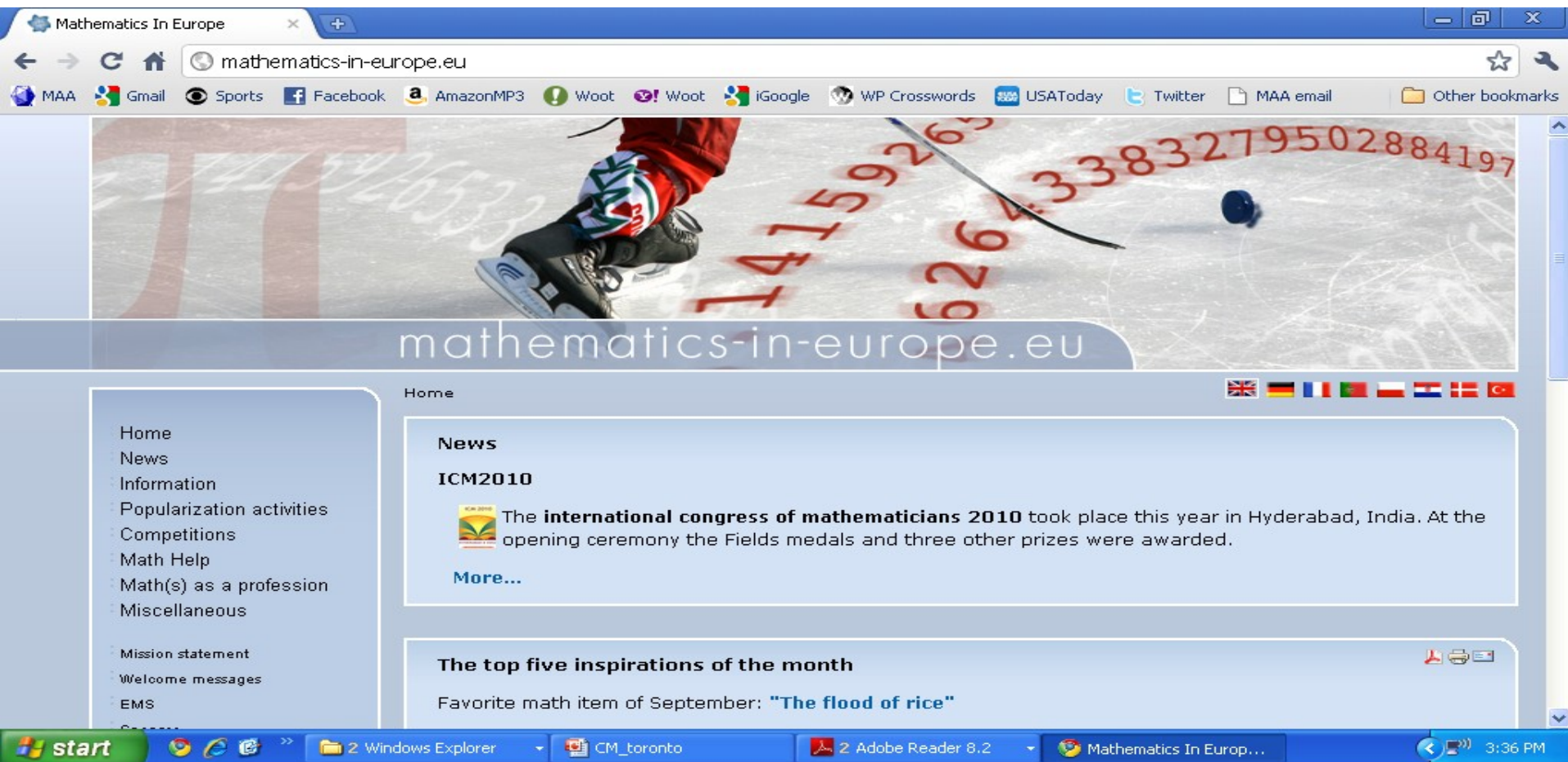
Earth is a planet with dynamic processes in the mantle, oceans and atmosphere, creating climate, creating natural resources, and influencing fundamental aspects of life and its supporting systems. It is critical to these natural processes to understand the complex systems of our planet, including natural and human systems. The mathematics of Planet Earth 2013 is a joint initiative of North American mathematics institutes and universities, bringing together mathematicians and scientists to work on the most important problems of our time. It is a joint initiative of North American mathematics institutes and universities, bringing together mathematicians and scientists to work on the most important problems of our time.

To learn more, visit the
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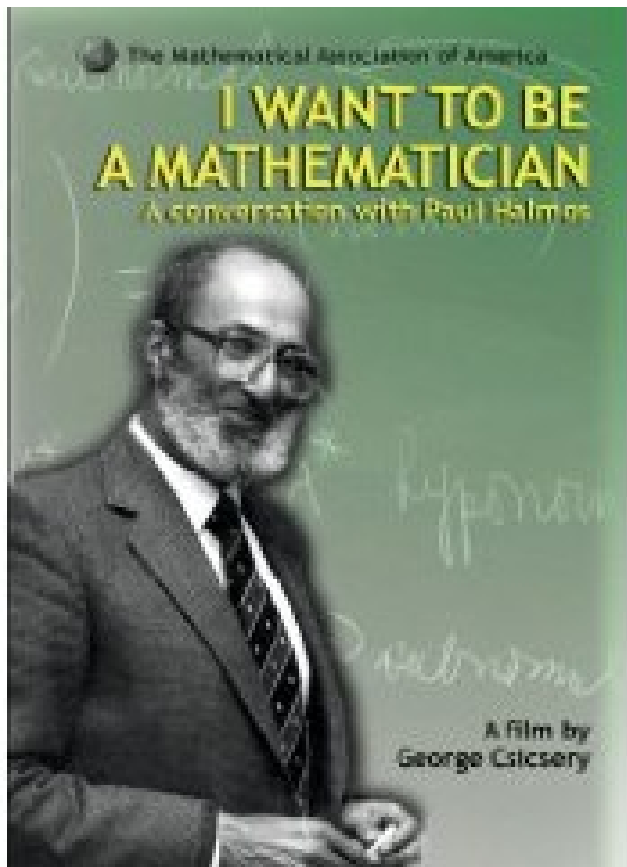
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Logos of participating institutions: American Institute of Mathematics, University of California, Berkeley, University of Michigan, University of Texas at Austin, University of Wisconsin-Madison, University of Illinois at Urbana-Champaign, University of Minnesota, University of California, San Diego, University of California, Los Angeles, University of California, Santa Barbara, University of California, Irvine, University of California, Merced, University of California, San Francisco, University of California, Davis, University of California, San Jose, University of California, Santa Cruz, University of California, Merced, University of California, San Francisco, University of California, Davis, University of California, San Jose, University of California, Santa Cruz.



<http://mathematics-in-europe.eu/>

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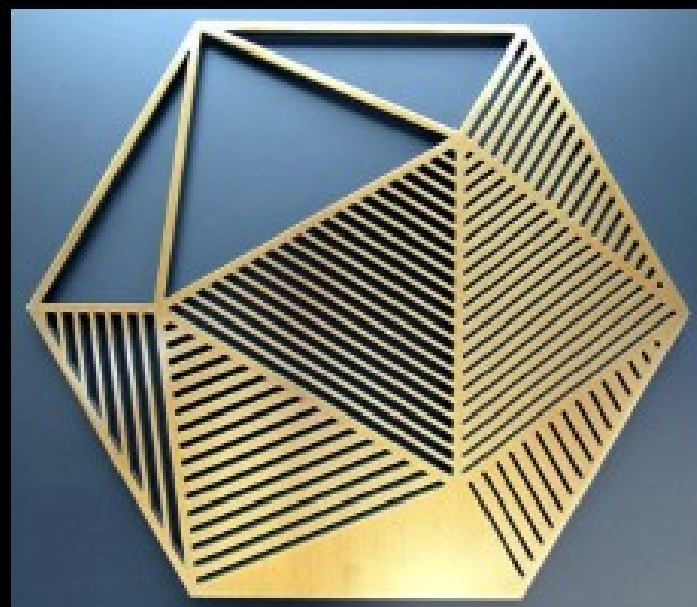
<http://www.zalafilms.com/films/halmos.html>

<http://www.youtube.com/watch?v=ONvYPIdXoZs>

Ivars Peterson

Director of Publications and Communications

Mathematical Association of America



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