Korean Three Kingdoms (18 BCE–660 CE)

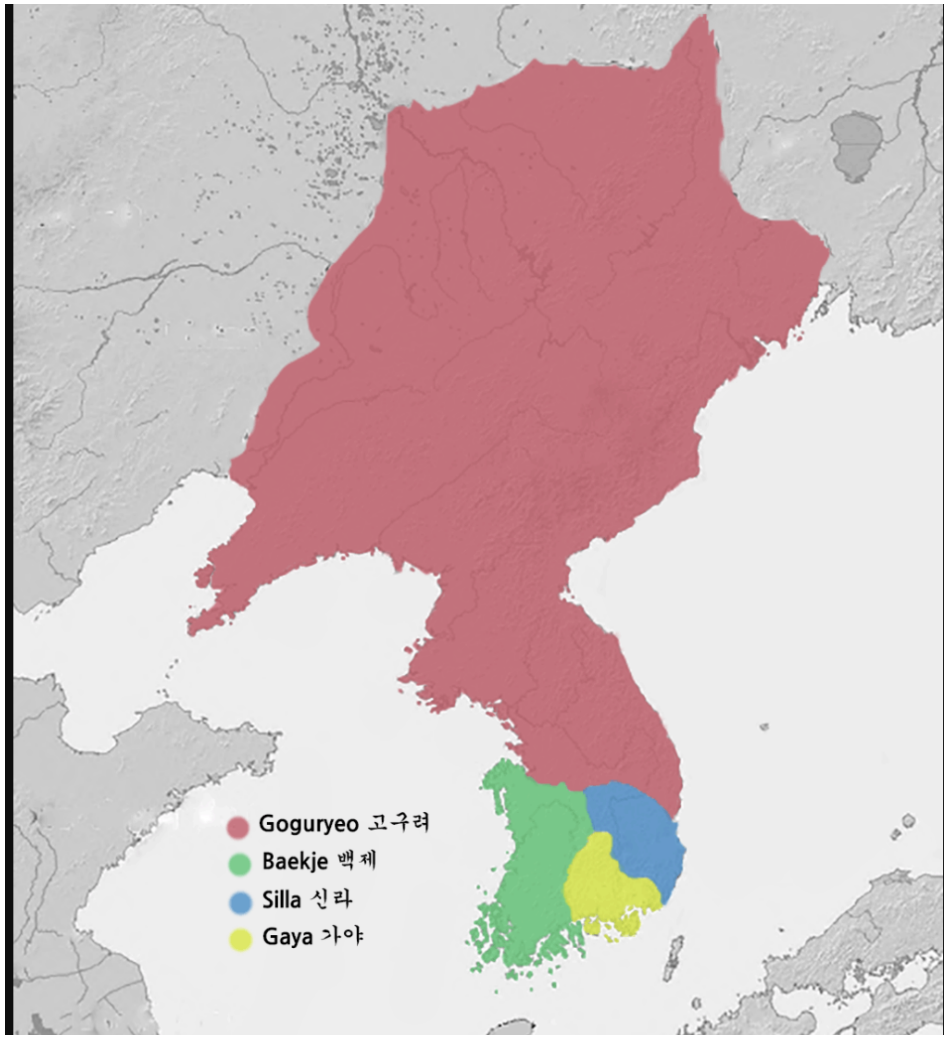

Figure: Three Kingdoms c. 476 CE (https://ko.wikipedia.org/wiki/삼국시대)

Korean Three Kingdoms (18 BCE–660 CE)

Figure: Unification in 676 CE (https://namu.wiki/w/통일신라)

Who Owns Mathematics?

Minhyong Kim
ICMS, Edinburgh
Korea Institute for Advanced Study

September, 2024
ICTS, Bengaluru

I. "A Timeless, Borderless Adventure"

Mathematics is a Timeless, Borderless Adventure

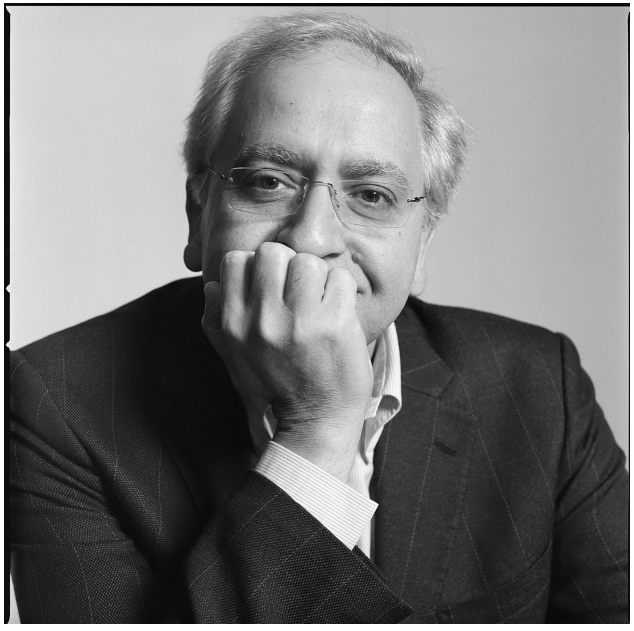

Figure: Cumrun Vafa, Mathematical Physicist

"...science is a timeless, borderless adventure. If we take a snapshot of science today we'll see various centers of excellence, and some places that may be relatively quiet, but we should view this as not the property of science, but as transient phenomena. Sometimes science is strong in one place, sometimes in the other. It is not a territory of a particular area, and it's not a territory of a particular people, it's an adventure for the entire human kind."

Square Roots: The Babylonian Algorithm

Square Roots: The Babylonian Algorithm

Figure: YBC 7289
(1800-1600 BCE)

Babylonian approximation:

$$\sqrt{2} \approx 1.41421297$$

Value in today's calculator:

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Value in today's calculator:

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To calculate $\sqrt{D}$ start with any guess a_1.

Then put

$$a_2 = (1/2)(a_1 + D/a_1);$$

$$a_3 = (1/2)(a_2 + D/a_2);$$

$$a_4 = (1/2)(a_3 + D/a_3);$$

$$\vdots$$

Square Roots: The Babylonian Algorithm

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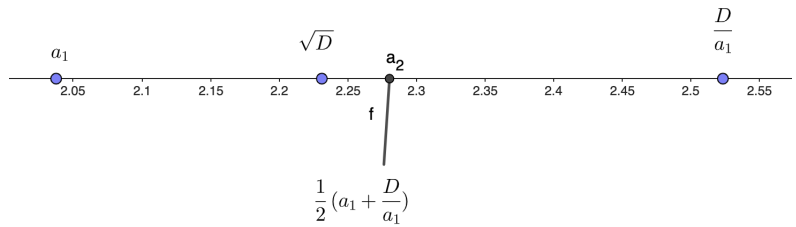
$$a_4 = (1/2)(17/12 + 24/17) = (1/2)(577/204) \approx 1.41421568$$

Babylonian Algorithm for Finding Square Roots



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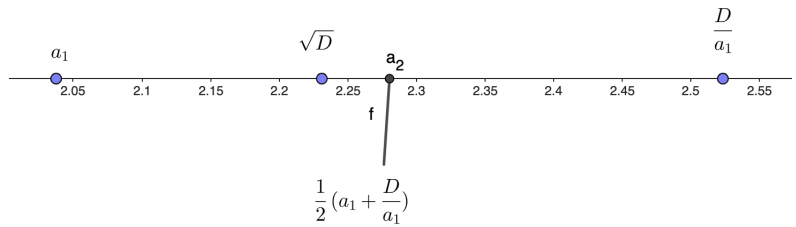
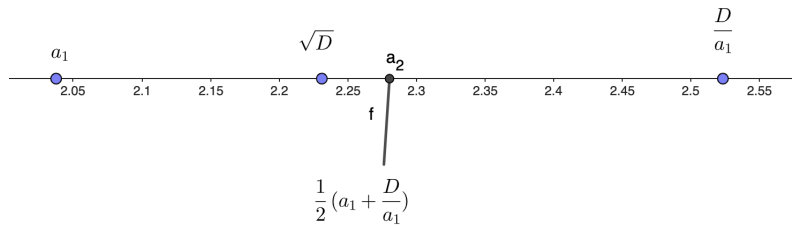


If $a_1 < \sqrt{D}$, then $D/a_1 > \sqrt{D}$, since

$$a_1 \cdot \frac{D}{a_1} = D$$

$$\sqrt{D} \cdot \sqrt{D} = D$$

Babylonian Algorithm for Finding Square Roots



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$$a_1 \cdot \frac{D}{a_1} = D$$

$$\sqrt{D} \cdot \sqrt{D} = D$$

Thus, $a_2 = (1/2)(a_1 + D/a_1)$ is closer to $\sqrt{D}$ than either.

Square Roots: The Babylonian Algorithm

Square Roots: The Babylonian Algorithm

The Babylonian algorithm was refined and developed by

–*Nine Chapters on the Mathematical Art* 九章算术 (10C BCE to 2C BCE)

–Heron of Alexandria (1C)

–Wang Xiaotong (7C)

–Brahmagupta (7C)

–Omar Khayaam (11C)

–Sharaf al-Din al-Tusi (12C)

–Jamshid al-Kashi (15C)

–Viete (16C)

–Newton and Raphson (17C)

–Gauss (19C)

Square Roots: The Babylonian Algorithm

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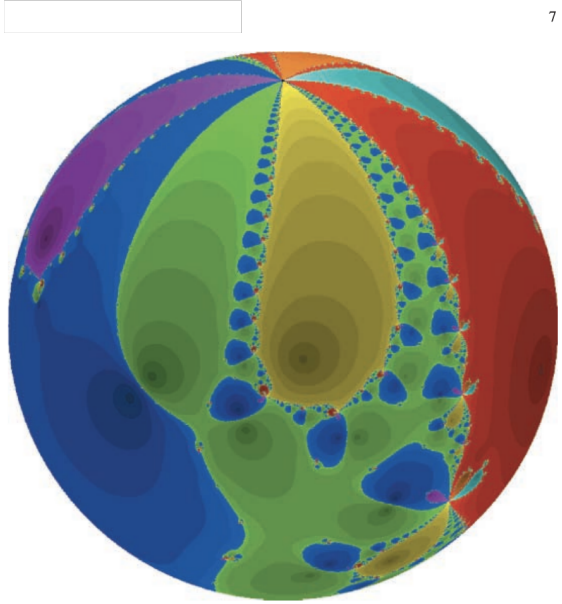

Figure: How to find all roots of complex polynomials by Newton's method (Inventiones Mathematica 2001)

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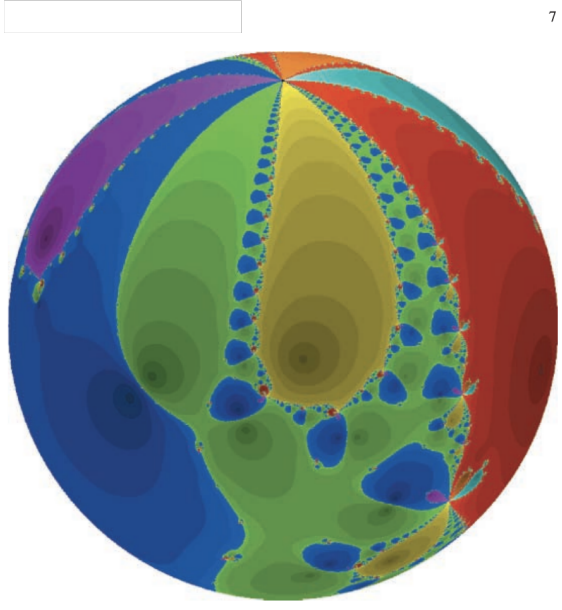

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Concluded nearly 4000 years of collective research.

II. Identities

Identities

Identities

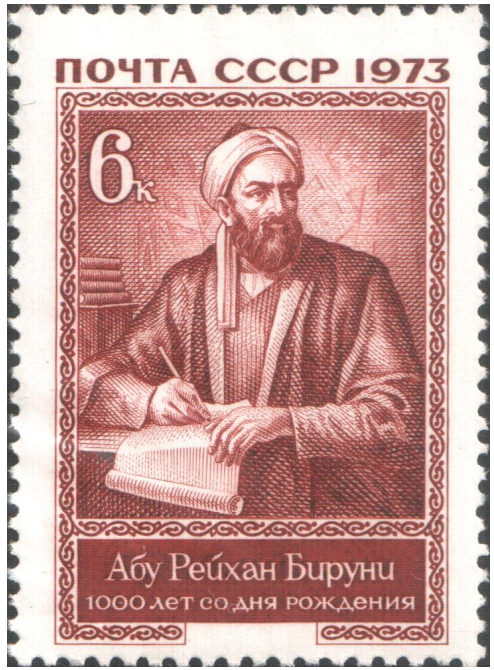

Figure: Abu Rayhan Muhammad ibn Ahmad al-Biruni (973-1050)

Identities

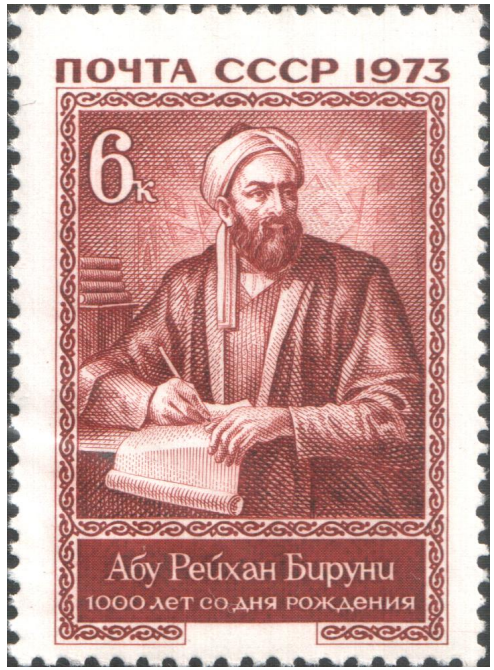

Figure: Abu Rayhan Muhammad ibn Ahmad al-Biruni (973-1050)

Probably used this method to calculate the radius of the earth to within 1% accuracy.

$$\cos(x) = \sqrt{\frac{1+\cos(2x)}{2}}.$$

Identities

Identities

Was al-Biruni Soviet?

Identities

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Was he Uzbek?

Identities

Was al-Biruni Soviet?

Was he Uzbek?

Was he Iranian?

Identities

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Identities

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Was he Persian?

Was he Arabic?

Identities: Misconceptions

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A.N. Whitehead *An Introduction to Mathematics* (1911):

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These people are regarded as non-Roman by definition.

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On what grounds?
How about

$$d_{gen}(\text{Minhyong Kim}, \text{Euclid}) \;??\; d_{gen}(\text{Sally Hemings}, \text{Euclid})$$

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We will all be included in a book on the global history of the English written by a future historian.

Identities: Misconceptions

Return to Whitehead:

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Why were Greeks and Romans 'leaders of the European world'?

Identities: Misconceptions

Aristotle's Politics, Book 7, 127b:

> *'The nations inhabiting the cold places and those of Europe are full of spirit but somewhat deficient in intelligence and skill, so that they continue comparatively free, but lacking in political organization and capacity to rule their neighbours. The peoples of Asia on the other hand are intelligent and skilful in temperament, but lack spirit, so that they are in continuous subjection and slavery. But the Greek race participates in both characters, just as it occupies the middle position geographically, for it is both spirited and intelligent; hence it continues to be free and to have very good political institutions, and to be capable of ruling all mankind if it attains constitutional unity.'*

Identities: Misconceptions

Herodotus Histories:

> *I cannot conceive why three names [Asia, Europe and Africa], and women's names especially, should ever have been given to a tract which is in reality one, nor why the Egyptian Nile and the Colchian Phasis [the modern Don River in Russia] should have been fixed upon for the boundary lines; nor can I even say who gave the three tracts their names, or whence they took the epithets.*

Identities: Misconceptions

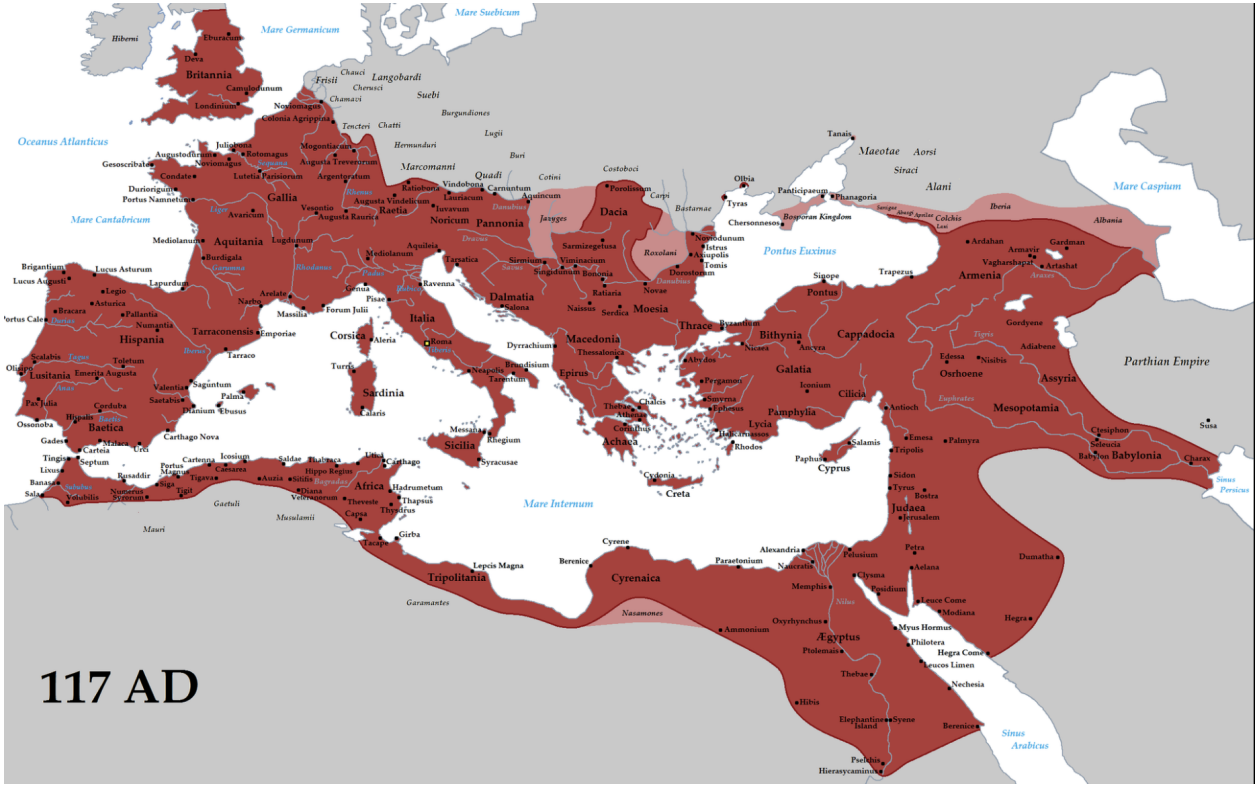

Figure: Roman Empire, early 2nd century

Identities: Misconceptions

Figure: Roman Empire, early 7th century

Identities: Misconceptions

Question:

Why is it so hard to find the statement ‘We invaded Rome’ in European history books?

Identities: Complexity

Identities: Complexity

Figure: Vercingetorix Monument (1865), Aimé Millet, Alesia

Identities: Complexity

Figure: Herman (Arminius) Monument (1838-1875), Ernst von Bandel,Teutoburg Forest

Identities: Complexity

Figure: *The Conspiracy of Claudius Civilis* (1661-62), Rembrandt, Swedish National Museum

III. Conclusion

History is Now

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The response of a number of distinguished mathematicians was that **mathematics is universal**.

History is Now

From open letter:

> *The theory of decoloniality is a postmodernist critique of the "European paradigm of rational knowledge". We believe that history suggests that mathematics is not a particularly European paradigm. On the contrary there are many examples where the same mathematical ideas have been developed independently across cultures. As just one example, the Japanese mathematician Seki and the Swiss mathematician Bernoulli both studied what are now called Bernoulli numbers. We agree that where practical the mathematical community should use terminology that gives non-Western mathematicians proper credit, but this is not the meaning of decoloniality.*

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Who are the 'Western' mathematicians?

Who Owns Mathematics?

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Mathematics and its history is full of diversity and unity.

Remarks

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Whitehead lived in a milieu where some Europeans had claimed the ancient Greco-Roman tradition by embracing and studying it. This was correlated with complicated identity politics in a Europe moving towards modernity.

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Euclid could be a role model for an African just as easily as for an American.

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To really convince ourselves and the global community of this, academics must educate themselves on current research into an accurate history of the ancient world.

In particular, we need to acquire and disseminate an accurate view of the history of mathematics.

We as mathematicians have nothing to lose and much to gain.

Current Research

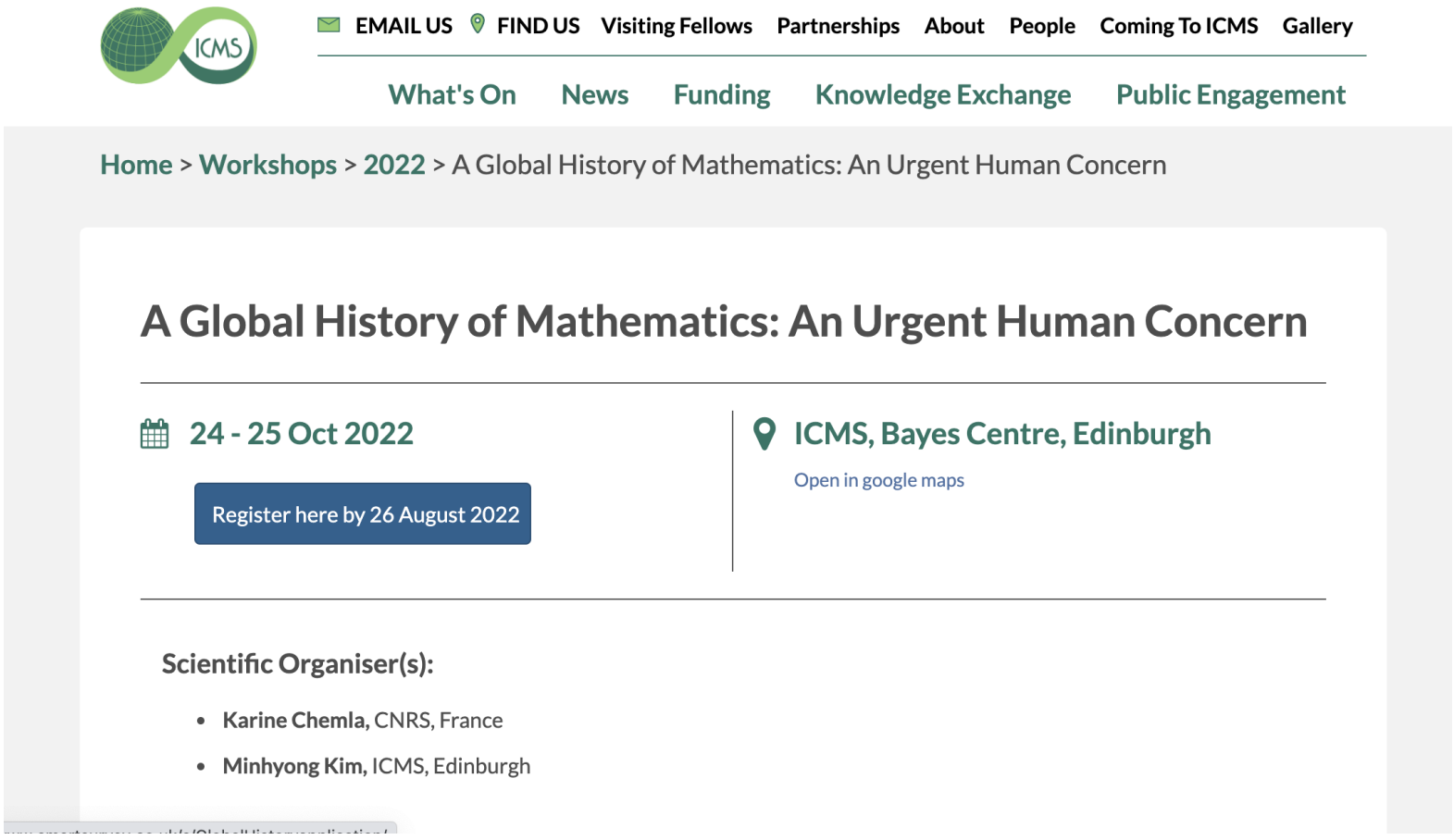
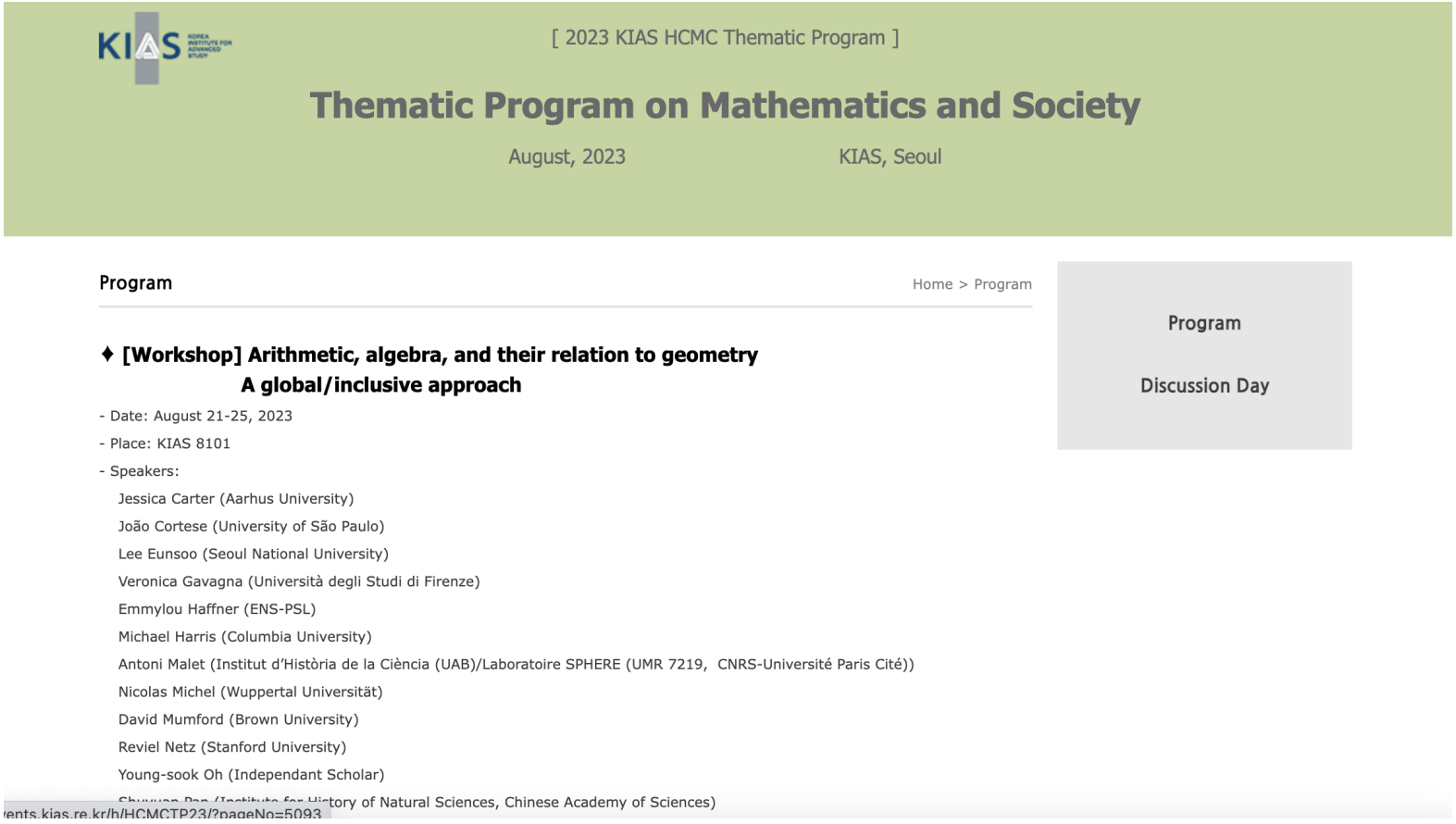


Figure: Workshop at the ICMS, October, 2022

Current Research



[2023 KIAS HCMC Thematic Program]

Thematic Program on Mathematics and Society

August, 2023 KIAS, Seoul

Program

Home > Program

Program

Discussion Day

♦ **[Workshop] Arithmetic, algebra, and their relation to geometry**
A global/inclusive approach

- Date: August 21-25, 2023
- Place: KIAS 8101
- Speakers:
  - Jessica Carter (Aarhus University)
  - João Cortese (University of São Paulo)
  - Lee Eunsoo (Seoul National University)
  - Veronica Gavagna (Università degli Studi di Firenze)
  - Emmylou Haffner (ENS-PSL)
  - Michael Harris (Columbia University)
  - Antoni Malet (Institut d'Història de la Ciència (UAB)/Laboratoire SPHERE (UMR 7219, CNRS-Université Paris Cité))
  - Nicolas Michel (Wuppertal Universität)
  - David Mumford (Brown University)
  - Reviel Netz (Stanford University)
  - Young-sook Oh (Independant Scholar)
  - Shuwuan Pan (Institute for History of Natural Sciences, Chinese Academy of Sciences)

ents.kias.re.kr/h/HCMCTP23/?pageNo=5093

Figure: Workshop at the Korea Institute for Advanced Study, August, 2023

Current Research

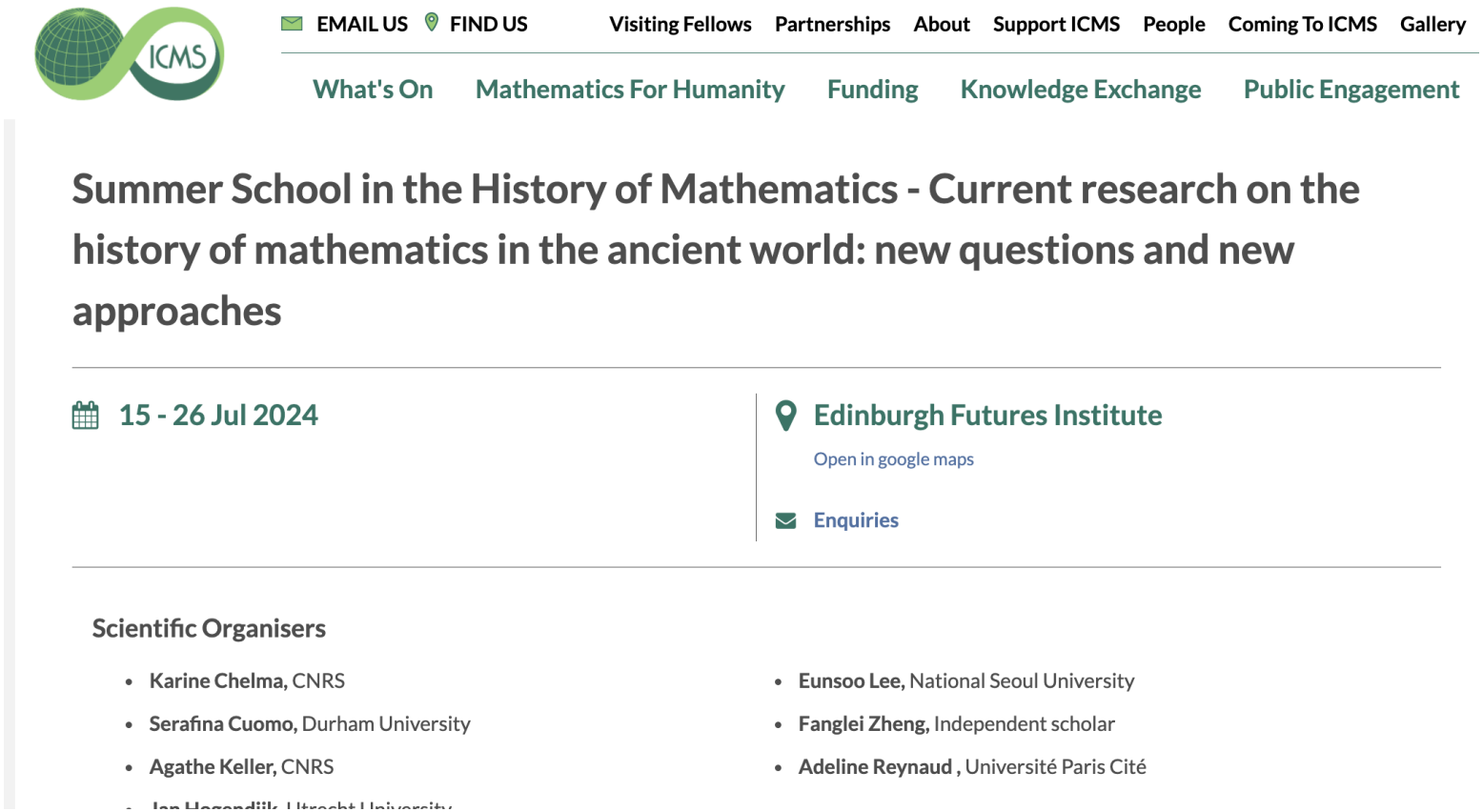
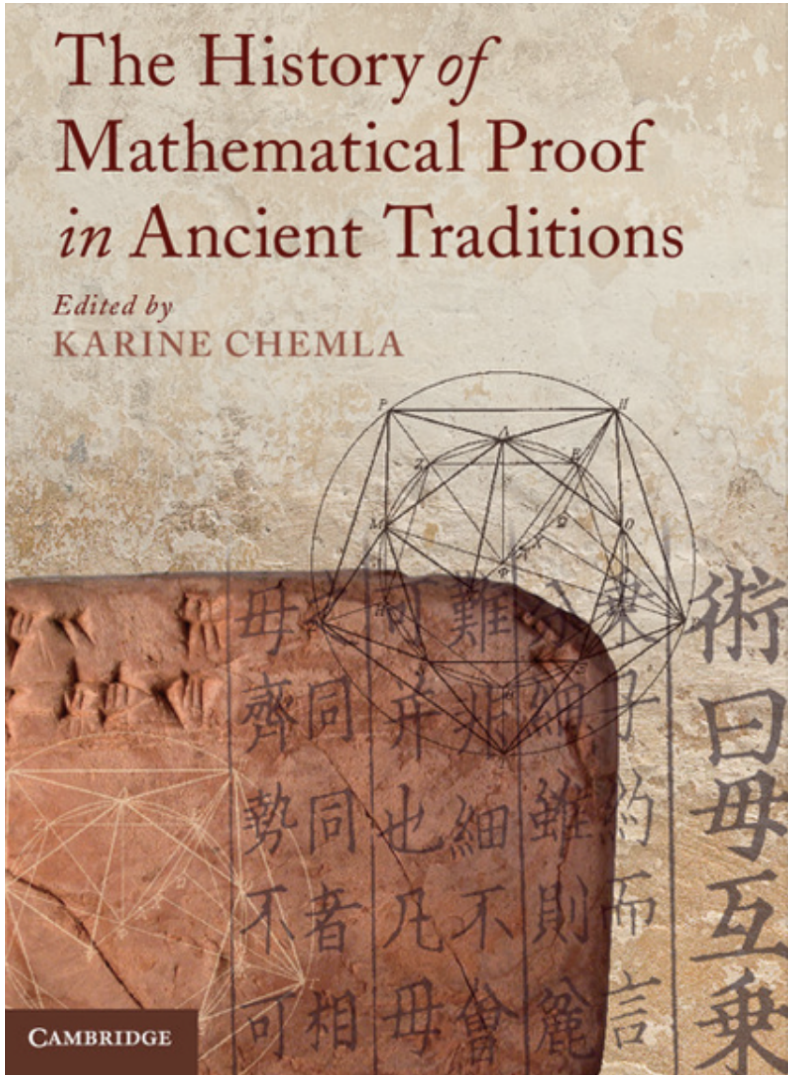


Figure: Summer School at the ICMS, July, 2024

Books

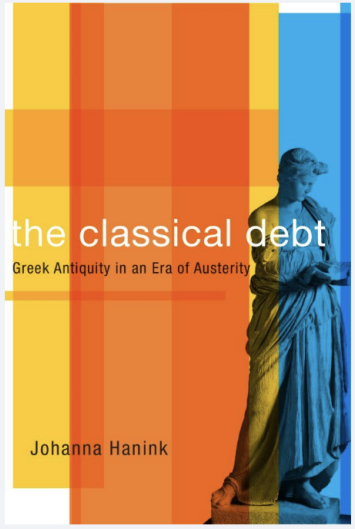


The standard history of mathematical proof in ancient traditions at the present day is disturbingly simple.

Books

Harvard University Press

Books Features Resources About Index



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Greek Antiquity in an Era of Austerity

Johanna Hanink

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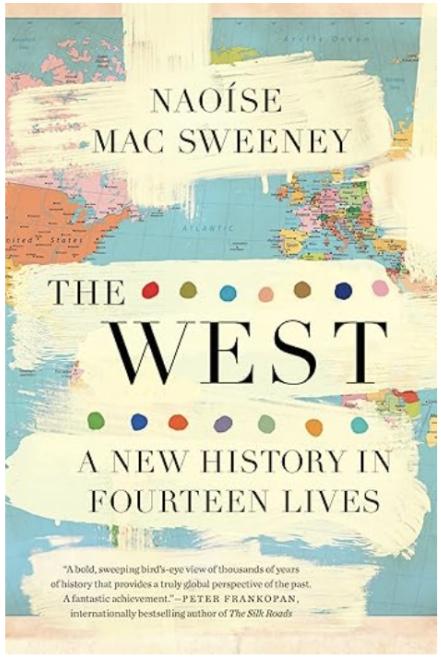
Books



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Hardcover – 23 May 2023

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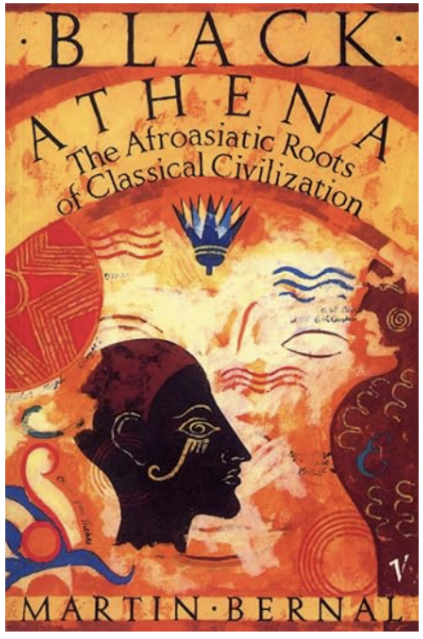

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Martin Bernal

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Black Athena: The Afroasiatic Roots of Classical Civilization Volume One:The Fabrication of Ancient Greece 1785-1985 Paperback – 21 Nov. 1991

by Martin Bernal (Author)

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Classical civilisation, Martin Bernal argues, has deep roots in Afro-Asiatic cultures. But these Afro-Asiatic influences have been systematically ignored, denied, or suppressed since the eighteenth century - chiefly for racist reasons.

The popular view is that Greek civilisation was the result of the conquest of a sophisticated but weak native population by vigorous Indo-European speakers--or Aryans--from the North. But the Classical Greeks, Bernal argues, knew nothing of this "Aryan model." They did not see their political institutions, science, philosophy, or religion as original, but rather as derived from the East in general, and Egypt in particular.

The Alternative View