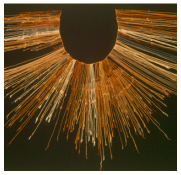
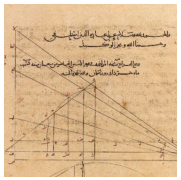
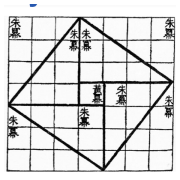
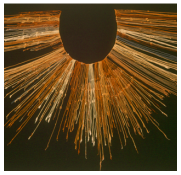
This week

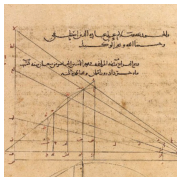
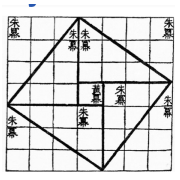


- A bit about this marvelous course (and boring adminstrivia)
- What do we mean by mathematics in this course?
- Sources: How do we know what we know in math history.
  - Early math source: The Ishango bone. Interpretations.
  - Primary and secondary sources.
  - Reliability of sources
- (Maybe) The beginning of counting.

These slides



Sources: How do we know what we know in math history.

- Early math source: The Ishango bone. Interpretations.
- Primary and secondary sources.
- Reliability of sources

"Our" Definition of Mathematics

- Study of ideas related to number, space, shapes, patterns, and structure, combined with logical reasoning

Historical Evidence

- Evidence of mathematical thinking from thousands of years ago: bones with markings, cave paintings
- By our definition, mathematics dates back far earlier than often assumed
- Example: Ishango bone
  - has **multiple interpretations**;
  - meaning remains disputed;
  - some interpretations impose modern assumptions onto ancient artifacts

First class

When Studying Historical Mathematical Evidence

- Consider historical and cultural context
- Avoid imposing our assumptions; let objects "speak" for themselves
- Distinguish facts from interpretations

Why Do We Believe What We Believe?

- Importance of peer-reviewed sources and verification
- Always ask: what evidence supports this claim?

About Thinking and Learning

- Excessive AI usage can seriously harm critical thinking
- AI often states falsehoods confidently—hard to detect
- Useful question type: "What do we mean by X?" rather than "What is X?"
- Expect uncertainty and multiple valid interpretations
- Growth mindset vs. fixed mindset

First class

Fixed mindset

Growth mindset

Instead of thinking	Try this
I am not good at this	What am I missing?
I can't make it any better	I can improve if I keep trying
I made a mistake. Therefore, I am not smart.	What can I learn from this mistake?
This is too hard. I give up	This might take longer than I expected
The problem is that X is smarter than me	I'll try to learn how X does it.
This is too easy for me	Can I understand this more deeply?

Discussion on the sources to use in this course.

Primary sources

Ishango Bone

A **primary source is** an original, firsthand, or direct piece of evidence or material that provides information about a particular topic or event.

- Primary sources they are **during the time period** which is being studied (correspondence, diaries, newspapers, government documents, art)
- They can also be **produced later** by eyewitnesses or participants (memoirs, oral histories).
- We are often going to work with **transcriptions and translation** of primary sources.

https://research.library.gsu.edu/HIST2110Primary

Primary sources

Ishango Bone

A **primary source is** an original, firsthand, or direct piece of evidence or material that provides information about a particular topic or event.

Examples:
- the Rhind Papyrus,
- Plimpton 322 (a Mesopotamian mathematical tablet),
- the Nine Chapters of the Mathematical Art and
- the works of Euler.

Primary sources include
- traditional print and manuscript texts
- non-written works
- social media posts
- recorded interviews

https://research.library.gsu.edu/HIST2110Primary

Give a concrete example of a mathematical primary source (with words, not just links). State a topic that can be studied using this document and explain how to access the text, including a translation if the original is not in English.
You may use Google, Google Scholar, the Stony Brook library website, AI tools, or other resources, but ensure that your example is real and appropriate.

Example The **Ishango bone** is currently housed at the Royal Belgian Institute of Natural Sciences (Institut Royal des Sciences Naturelles de Belgique) in Brussels, Belgium. https://www.naturalsciences.be/en/museum/exhibitions-activities/exhibitions/250-years-of-natural-sciences/the-ishango-bone

Examples of primary sources

Section of the Rhind Papyrus -British Museum

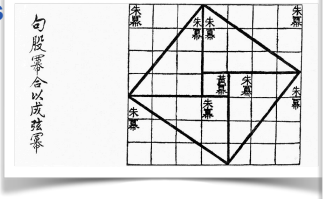
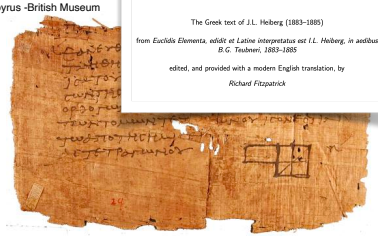
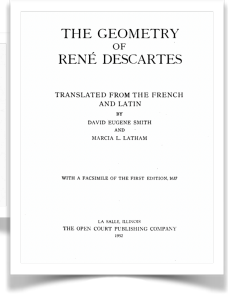


Diagram added by Zhao Shuang (3rd century BCE) to the Zhoubi Suanjing that can be used to prove the Pythagorean Theorem

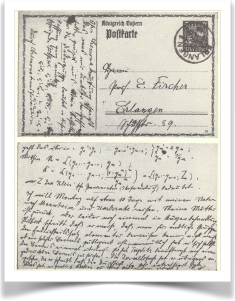


Fragment of what is likely part of a larger papyrus roll from the early years of the current era. Found in Oxyrhynchus (about 110 miles up the Nile from Cairo and 10 miles west of it. Oxyrhynchus at that time was populated by Greek colonists, a remnant of the conquest in about 330 B. C. by Alexander the Great. The fragment contains the statement, in Greek, of Proposition 5 from Book II of Euclid's Elements
Image Credit: https://personal.math.ubc.ca/~cass/euclid/papyrus/

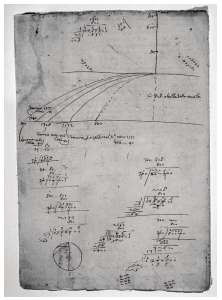


Translation of Descartes' "La Geometry"

Quipu
By Claus Ableiter nur hochgeladen aus enWiki - enWiki, hochgeladen von User Lyndsarueil; siehe http://en.wikipedia.org/wiki/Image:Inca_Quipu.jpg, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=2986739

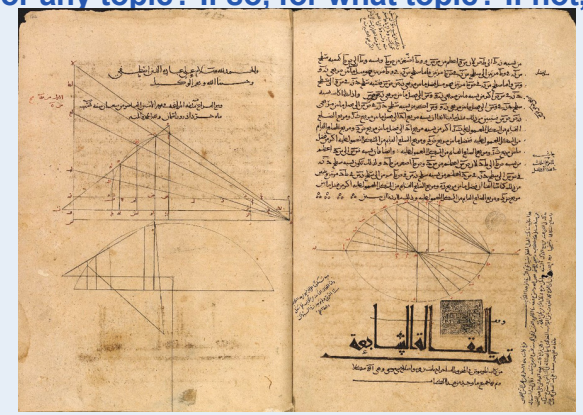


Postcard from Emmy Noether to E. Fischer. Postmarked 10 April 1915. - Public Domain



A page from Galileo's notebooks, showing an experiment such as the one described here. See Stillman Drake, Galileo's Notes on Motion, monograph 5, Annali dell'Istituto e Museo di Storia della Scienza (Florence, 1979), p. 79.

Book V on Conic Sections was written in the 3rd century BCE, likely between 200 and 190 BCE. Its author, Apollonius of Perga, worked in Perga (now Turkey) and later in Alexandria, Egypt.
Is the 9th-century Arabic translation of the Book V a primary source for any topic? If so, for what topic? If not, why not?



Pages from the 9th century Arabic translation of the Conics

Note: A document can be a primary source for a certain topic and not for other.

Secondary sources

Secondary sources are works that study a topic through studying, researching, analyzing and interpreting primary sources.

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Secondary sources include books and articles written from a historical perspective (later in time), reviews, textbooks, biographies, and indexes.

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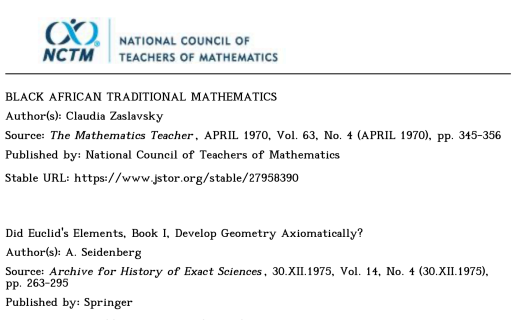
Secondary sources are works that study a topic through studying, researching, analyzing and interpreting primary sources.

In the bibliographies of your paper and presentation, you can **only use relevant secondary sources which are from peer reviewed journals written in English** (One way to find them is through the SB library or JSTOR- linked in the course website). If you are in doubt of your source, consult with me.

Every item in your bibliography should be referenced.

Every fact in your paper that is not common knowledge, **should have a reference** to an item in your bibliography.

Examples of secondary sources



NCTM NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

BLACK AFRICAN TRADITIONAL MATHEMATICS
Author(s): Claudia Zaslavsky
Source: *The Mathematics Teacher*, APRIL 1970, Vol. 63, No. 4 (APRIL 1970), pp. 345-356
Published by: National Council of Teachers of Mathematics
Stable URL: https://www.jstor.org/stable/27958390

Did Euclid's Elements, Book I, Develop Geometry Axiomatically?
Author(s): A. Seidenberg
Source: *Archive for History of Exact Sciences*, 30.XII.1975, Vol. 14, No. 4 (30.XII.1975), pp. 263-295
Published by: Springer
Stable URL: http://www.jstor.com/stable/41133436

Jiu Zhang Suanshu 九章算術 (Nine Chapters on the Mathematical Art): An Overview
Author(s): Lam Lay Yong
Source: *Archive for History of Exact Sciences*, June 1994, Vol. 47, No. 1 (June 1994), pp. 1-51
Published by: Springer
Stable URL: https://www.jstor.org/stable/41133972

Problems 1 to 6 of the Rhind Mathematical Papyrus
Author(s): R. J. Gillings
Source: *The Mathematics Teacher*, JANUARY 1962, Vol. 55, No. 1 (JANUARY 1962), pp. 61-69
Published by: National Council of Teachers of Mathematics
Stable URL: http://www.jstor.com/stable/27956523

The World's First Mathematics Textbook

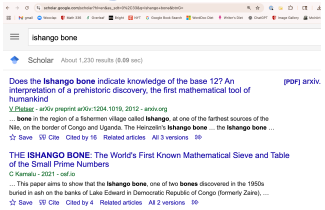
UNDERWOOD DUDLEY DePauw University

The Stony Brook Library

https://search.library.stonybrook.edu/discovery/search?query=any,contains,Ishango%20bone&tab=Everything&search_scope=EverythingNZBooks&vid=01SUNY_STB:01SUNY_STB&offset=0

Search: Ishango bone

Google scholar



https://scholar.google.com/scholar?hl=en&as_sdt=0%2C33&q=ishango+bone&btnG=

Give a concrete example of a mathematical, peer reviewed. secondary source. State a topic that can be studied using this secondary source.
Feel free to use Google, Google Scholar, the Stony Brook library website, , AI (artificial intelligence)… but check it.

Hint: Use jstor.org or the SB library (https://library.stonybrook.edu/) or Google Scholar or AI

Which of the following best defines a primary source? And a secondary source? Join with arrows

Can this website be considered as secondary source?
Is it reliable? Can you use it for your work in this course? Why or why not?

https://www.storyofmathematics.com/

A reliable website?

According to some authorities, there is evidence of basic arithmetic and geometric notations on the petroglyphs at Knowth and Newgrange burial mounds in Ireland (dating from about 3500 BCE and 3200 BCE respectively). These utilize a repeated zig-zag glyph for counting, a system that continued to be used in **Britain and Ireland** into the 1st millennium BCE.

Stonehenge, a Neolithic ceremonial and astronomical monument in England, which dates from around 2300 BCE, also arguably exhibits examples of the use of 60 and 360 in the circle measurements, a practice which presumably developed quite independently of the sexagesimal counting system of the ancient Sumerian and Babylonians.

https://www.storyofmathematics.com/prehistoric.html

A reliable website?

the left column represented larger values, much as in the modern decimal system, although of course using base 60 not base 10. Thus, 𒐗𒐗𒐗 in the Babylonian system represented 3,600 plus 60 plus 1, or 3,661. Also, to represent the numbers 1 – 59 within each place value, two distinct symbols were used, a unit symbol (𒐗) and a ten symbol (𒌋) which were combined in a similar way to the familiar system of Roman numerals (e.g. 23 would be shown as 𒌋𒌋𒐗𒐗𒐗). Thus, 𒐗 𒌋𒌋𒐗𒐗𒐗 represents 60 plus 23, or 83. However, the number 60 was represented by the same symbol as the number 1 and, because they lacked an equivalent of the decimal point, the actual place value of a symbol often had to be inferred from the context.

Babylonian Numerals

It has been conjectured that **Babylonian advances in mathematics** were probably facilitated by the fa that 60 has many divisors (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 and 60 – in fact, 60 is the smallest integer divisible by all numbers from 1 to 6), and the continued modern-day usage of of 60 seconds in a minute, minutes in an hour, and 360 (60 x 6) degrees in a circle, are all testaments to the ancient Babylonian system. It is for similar reasons that 12 (which has factors of 1, 2, 3, 4 and 6) has been such a popular multiple historically (e.g. 12 months, 12 inches, 12 pence, 2 x 12 hours, etc).

But it contains information!

The Babylonians also developed another **revolutionary mathematical concept**, something else that the Egyptians, Greeks and Romans did not have, a circle character for zero, although its symbol was really still more of a placeholder than a number in its own right.

https://www.storyofmathematics.com/sumerian.html

A reliable source?

https://www.britannica.com/science/mathematics/Mathematics-in-ancient-Egypt

"The same way you can feed your body junk food, we are feeding our mind junk information. We need an information diet. People should think carefully about the amounts and the quality of the information they take in."

Yuval Noah Harari