

Welcome to MATH 3820H

①

Medieval to Modern Mathematics

Cover: Mathematics in India \rightarrow Islamic world \rightarrow Europe

- tracing the spread of the Hindu-Arabic number system
- development of algebra (and abstraction...)

Potted (pre-) history of India:

c. 2500-1700 BC Harappan or Indus Valley civilization

- similar technology to their contemporary Mesopotamians (with whom they traded)
- large cities at Harappa & Mohenjo Daro
- had writing but the language is undeciphered
- uniform system of weights and measures

c. 1500 BC on - Indo-Aryan migrations into Northwest India & on from there

- led to the establishment of Vedic culture (proto-Hindu)
- the Vedas began being written down c. 900 B.C.

c. 800 BC - 200 BC. - composition of the Sulva Sutras
("Rules of the Cord")

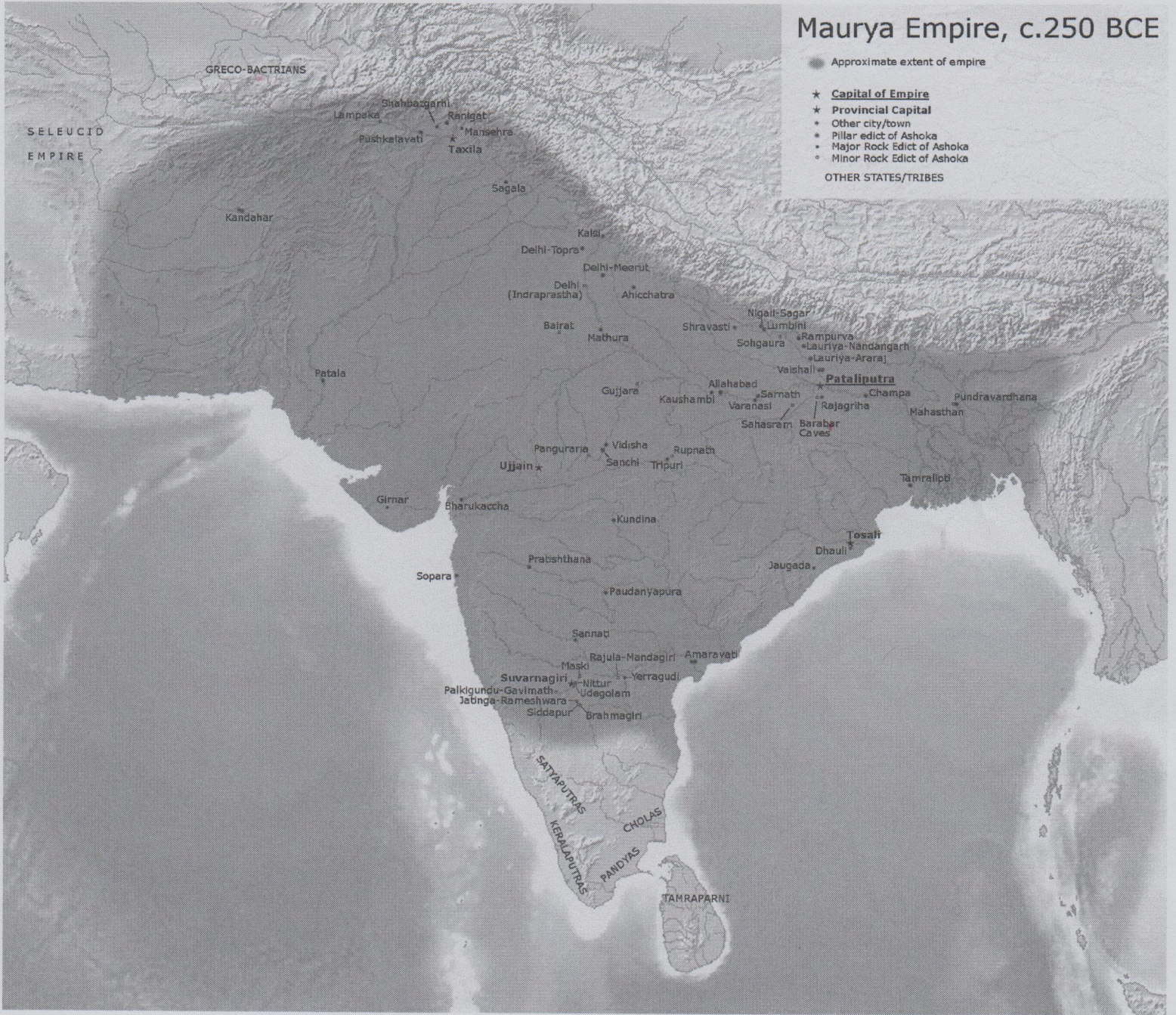
- manuals for various engineering & construction problems for religious purposes
- considerable mathematical content
 - instances of the Pythagorean
 - doubling square
 - several approximations

c. 600 B.C. - founding of Jainism by Mahavira
- founding of Buddhism by Gautama Buddha

326 BC. - Alexander the Great's army reached the Indus river and refused to go on, so he returned to Mesopotamia.

322 - 184 BC. - Marayan or Mauryan Empire
- founding emperor Chandragupta Maurya (322-298 BC) promoted Jainism
- his grandson Ashoka (268-232 BC) brought the empire to its greatest extent, then converted to Buddhism

Maurya Empire, c.250 BCE



● Approximate extent of empire

- ★ Capital of Empire
- ★ Provincial Capital
- ★ Other city/town
- Pillar edict of Ashoka
- Major Rock Edict of Ashoka
- Minor Rock Edict of Ashoka
- OTHER STATES/TRIBES

From 100-250 A.D. a large part of northern India was part of the Kushan Empire.

(3)

280 A.D. - 550 A.D. - Gupta Empire

Aryabhata (476 - 550 A.D.) - lived and worked in the capital of the Gupta Empire, Pataliputra.

- mathematician & astronomer

- used letters & words to represent numbers in a base 10 system

- wrote his work as poetry

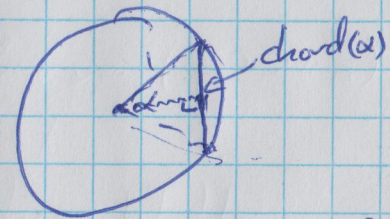
- worked on algebra and trigonometry

worked on
Diophantine
equations

first one we have a record of to
use sines (half-chord)

- astronomer: - held to a heliocentric theory

- gave very precise value of the length of the day (23 hrs 56 min 4.1 sec)
(actual 23 hrs 56 min 4.091 sec)



$$\text{chord}(\alpha) = 2 \sin\left(\frac{\alpha}{2}\right)$$

- some of his work was translated into Arabic in the 7th century

His major surviving work is the Arjabhātīya

(9)

a mix of astronomy & math

- no proofs
- original is in Sanskrit poetry
- hard to understand in some cases
 - look at his method for computing square roots...
- some formulas are only approximations
- implicitly uses a pretty accurate value of π (3.16...)

— = ≡ ≠ १ २ | ७ ८ ९ ०

Brāhmī



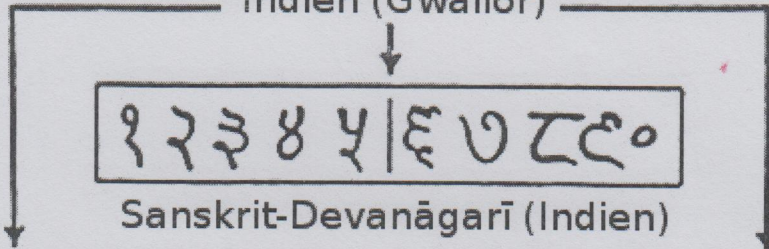
१ २ ३ ४ ५ | ६ ७ ८ ९ ०

Indien (Gwâlior)



१ २ ३ ४ ५ | ६ ७ ८ ९ ०

Sanskrit-Devanāgarī (Indien)



١ ٢ ٣ ٤ ٥ | ٦ ٧ ٨ ٩

Arabe occidental (Gobâr)

١ ٢ ٣ ٤ ٥ | ٦ ٧ ٨ ٩ ٠

Arabe oriental

١ ٢ ٣ ٤ ٥ | ٦ ٧ ٨ ٩ ٠

XIe siècle (Apices)

١ ٢ ٣ ٤ ٥ | ٦ ٧ ٨ ٩ ٠

XVe siècle

1 2 3 4 5 | 6 7 8 9 0

XVIe siècle (Dürer)