A too short, not objective enough, history of geometry

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The rise of mathematics in general and Geometry in particular has its origin in the help given to rulers. MATHS have been considered as HELPFUL…

…In Trade / Economy…

For correct accounting
For profitable tax collecting
For safe sea travelling…

…For understanding the world and acting on it…

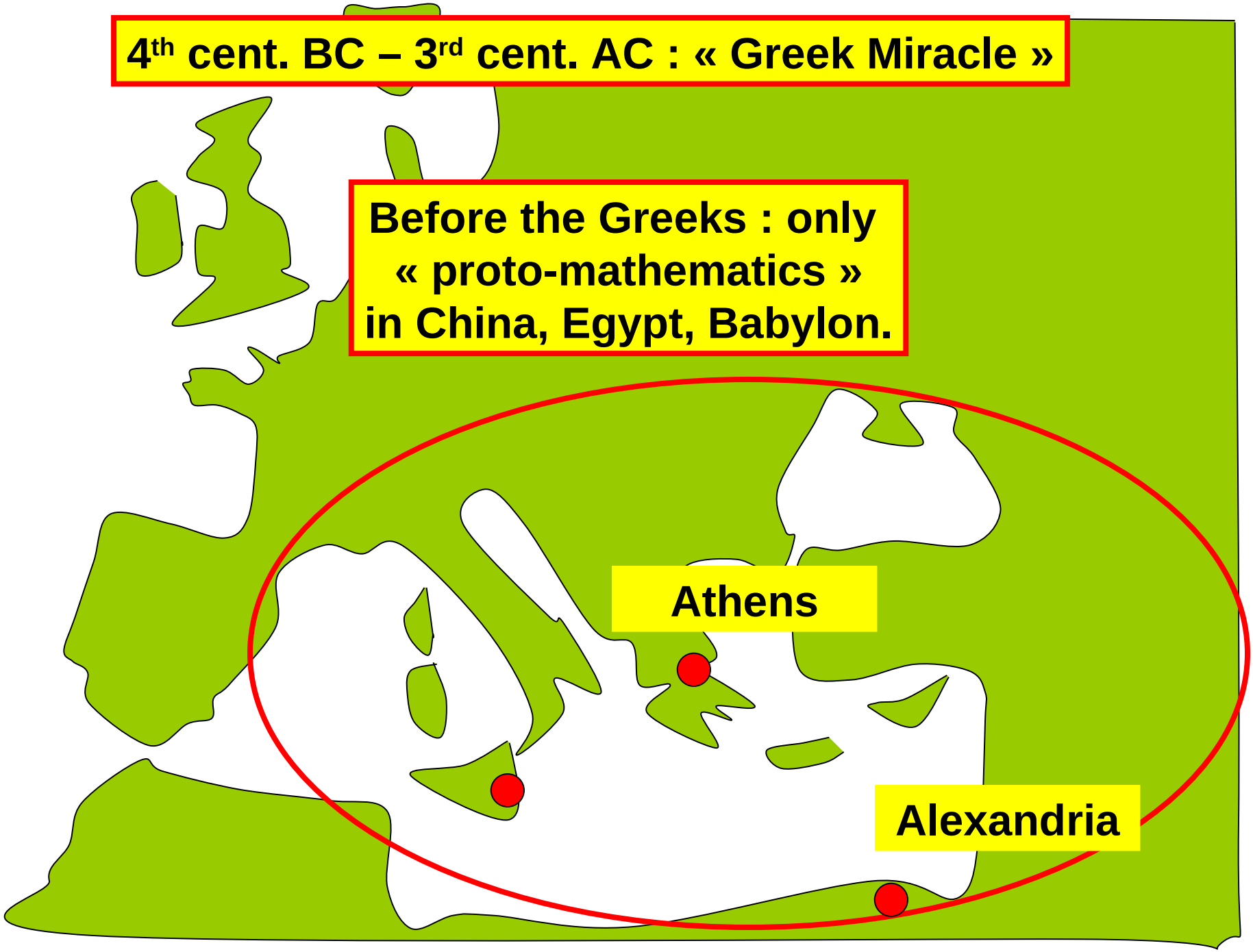
Mathematics are everywhere in science and technology…

…For Power / Beliefs…

For good building
For « good » fighting
For prestige
For « sky interpretation »

…And thorough Teaching Systems are fundamental…

A recipe that works:
Selected teachers +
Selected students +
Good teaching methods
=> Scientific elite


4th cent. BC – 3rd cent. AC : « Greek Miracle »
Before the Greeks : only
« proto-mathematics »
in China, Egypt, Babylon.
Athens
Alexandria

Greek Mathematics :

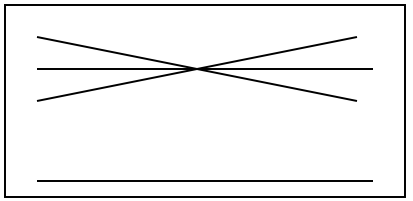
EUCLID of Alexandria (3rd c. BC.) : « The elements ».

= axioms + theorems (« Gods' truth ») + proofs.

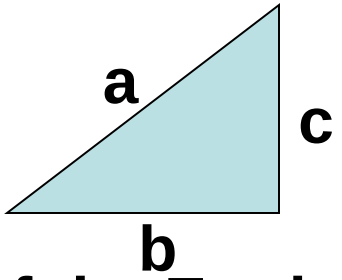
Birth of hypothetico-deductive reasoning

Famous axiom : 5th axiom.

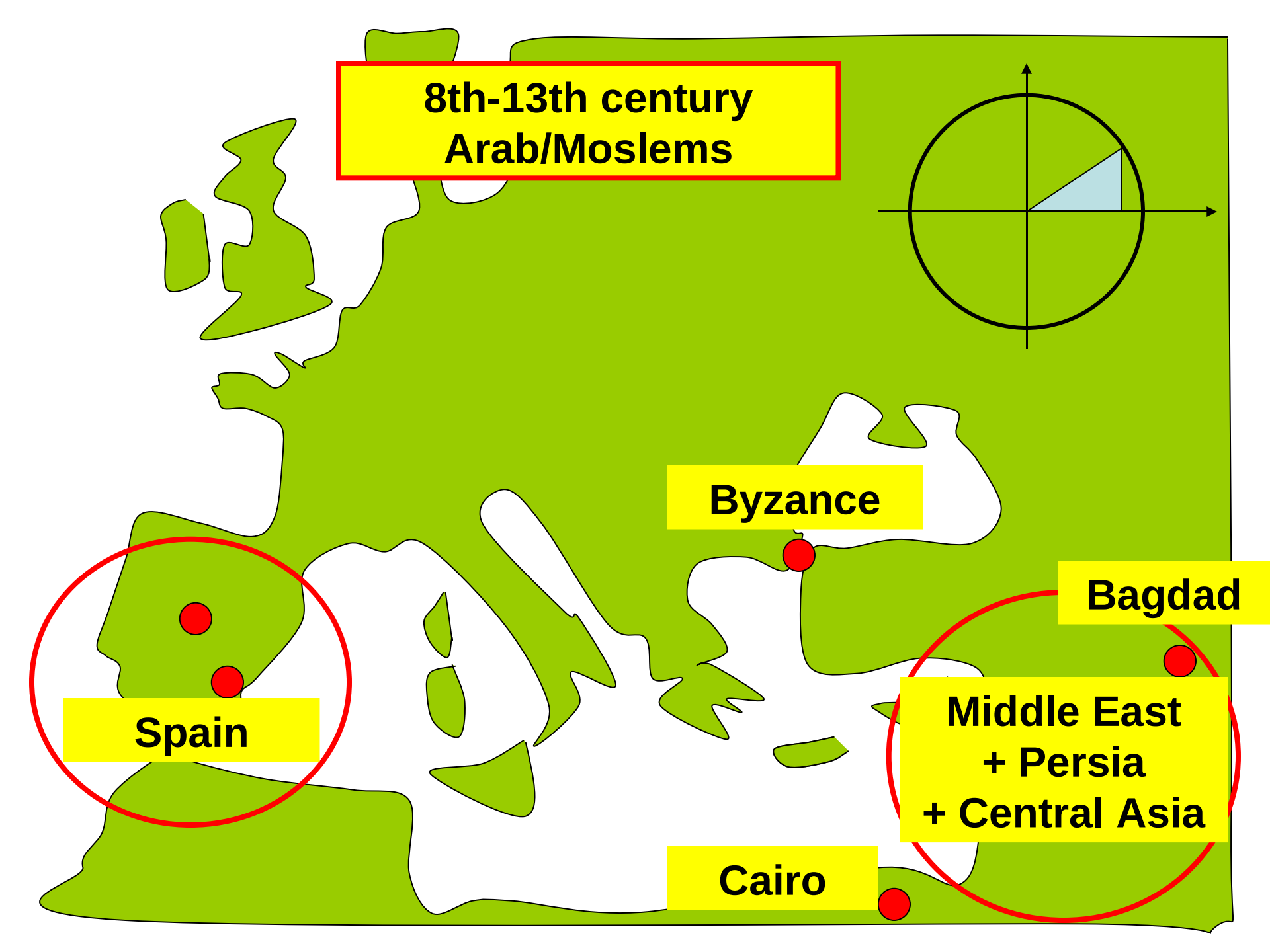
Famous theorem :
« Pythagoras theorem »



No place for algebra at that time…
(but coordinates did exist…)

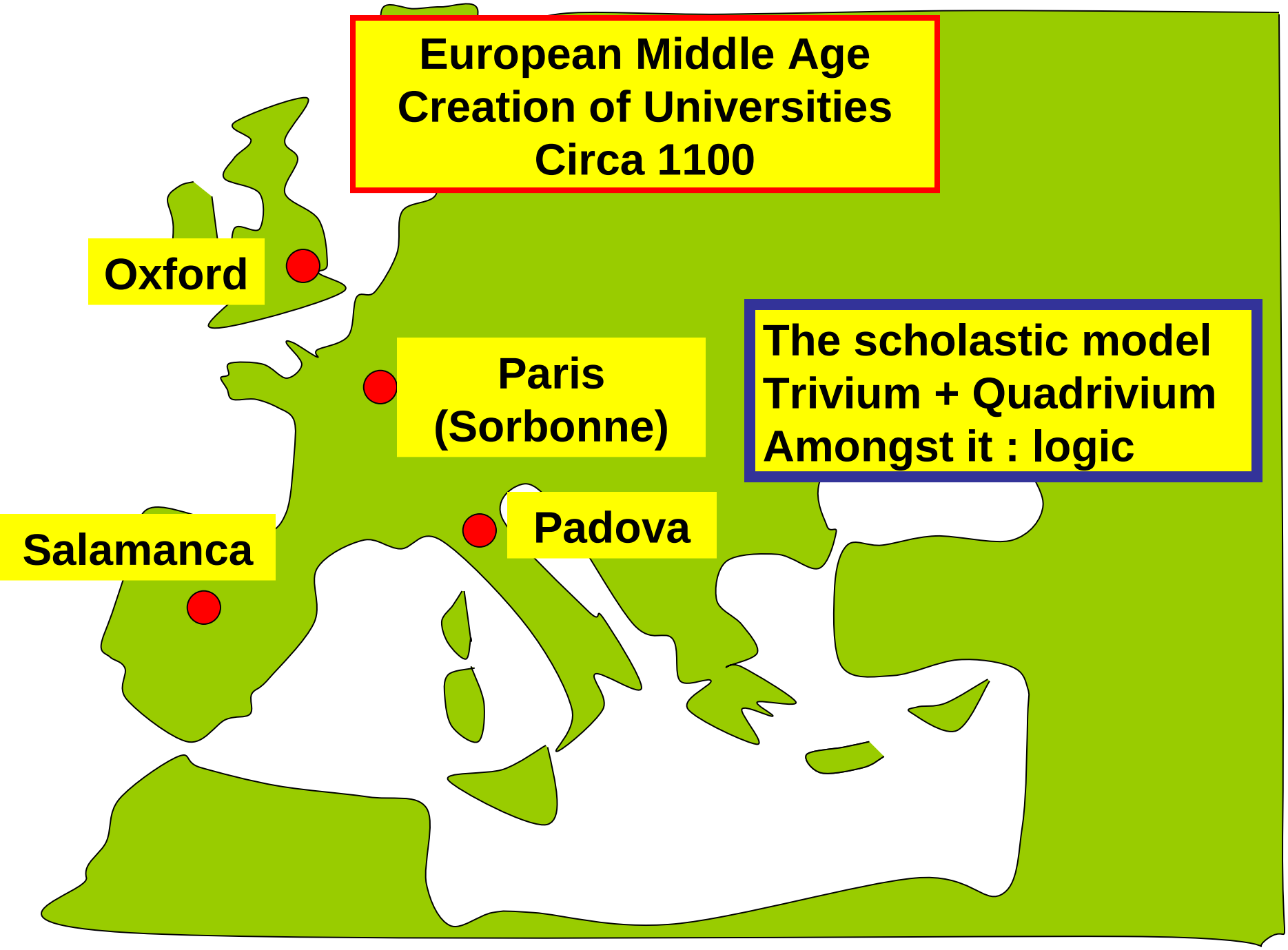


Many others :
HERON of Alexandria : Geometry (« measure of the Earth »)
ARCHIMEDES of Syracuse (-200) (Maths and Physics)
APOLLONIUS of Perga (-200): conics…
DIOPHANTES of Alexandria : Arithmetic, etc…


8th-13th century
Arab/Moslems
Byzance
Bagdad
Spain
Middle East
+ Persia
+ Central Asia
Cairo

Moslem civilization : (arabs + persians + …)

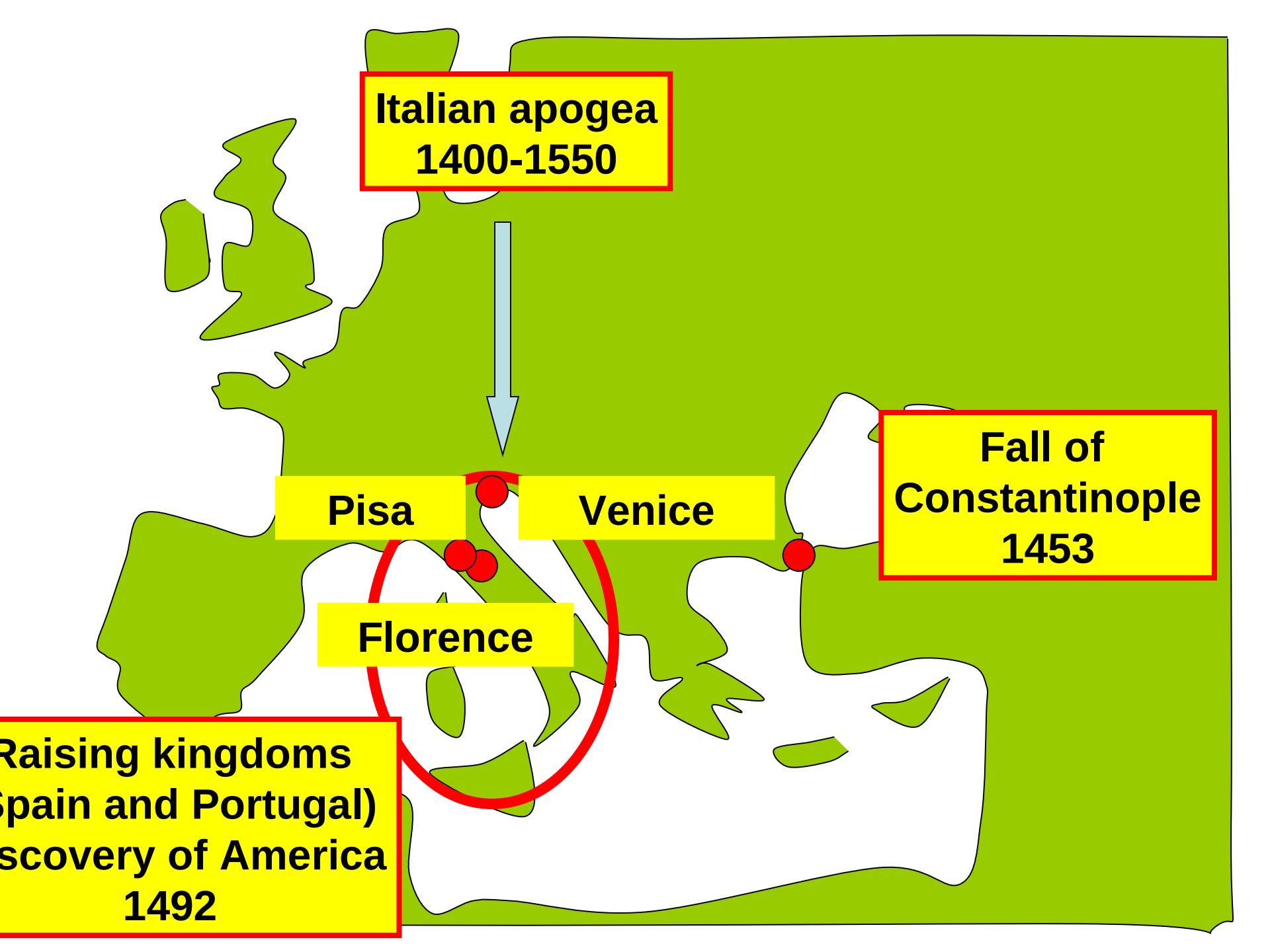
- **Translation of most Greek works (those who wher not lost) into arabic.**
  (Later on, translation from arabic to latin by Christian or Jewish scholars who studied in moslem universities in Spain).
- **Development of trigonometry.**
- **Early stage of algebra**
  (« Al Gebr wal muqabala »)


European Middle Age
Creation of Universities
Circa 1100
Oxford
Paris
(Sorbonne)
Padova
Salamanca
The scholastic model
Trivium + Quadrivium
Amongst it : logic

Absolute authority of (some) greek masters :
« Aristoteles dixit »

No progress in geometry : Euclides is the master.

Some progresses in logic
« bArbArA cElArEnt»
syllogism…

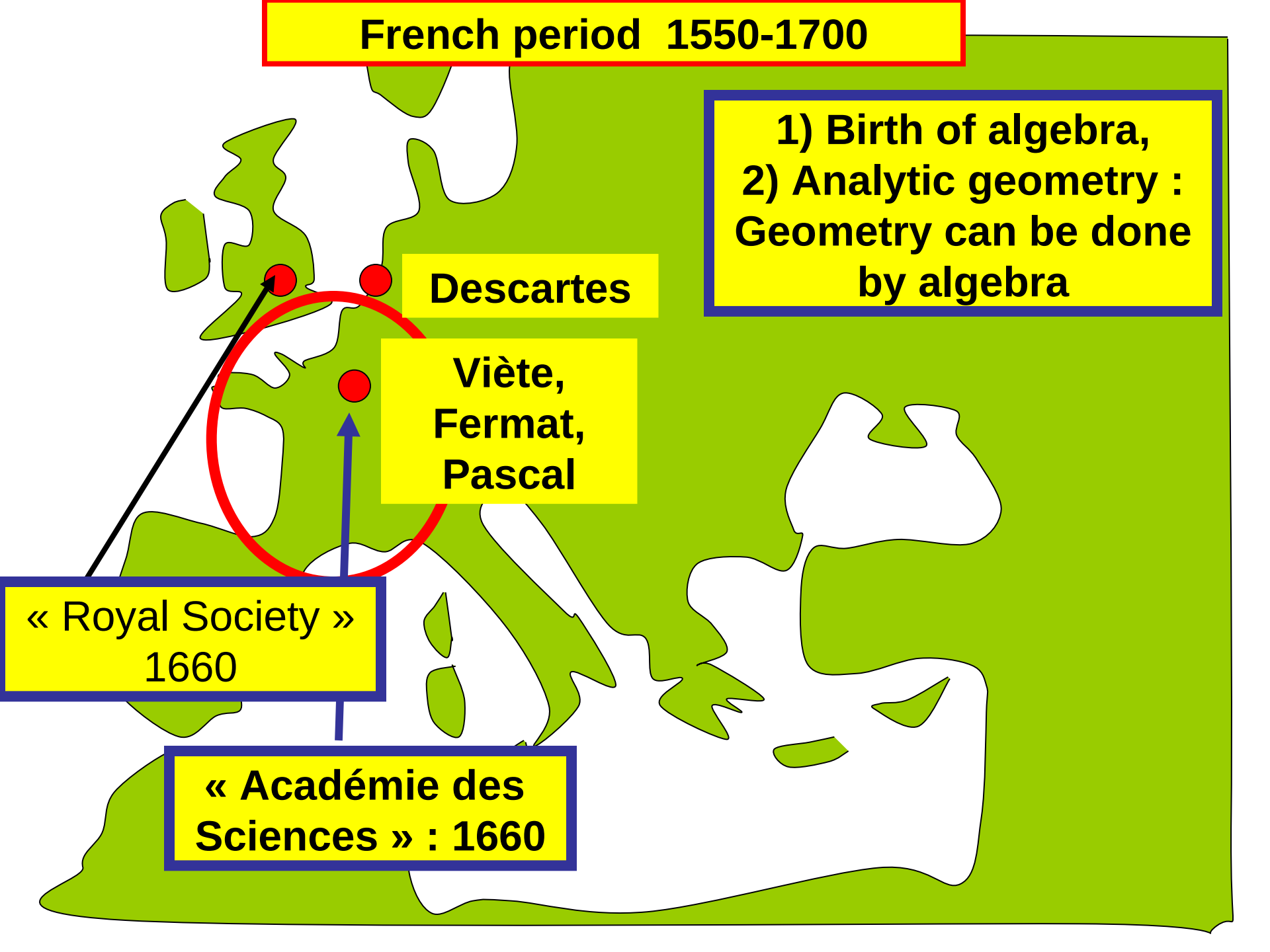

Italian apogea
1400-1550
Pisa
Venice
Florence
Fall of
Constantinople
1453
Raising kingdoms
Spain and Portugal)
scovery of America
1492

<u>Italian Renaissance (quatrocento)</u> :

- Cross fertilizing between different sciences and arts (Leonardo da Vinci)

Geometry : perspective.

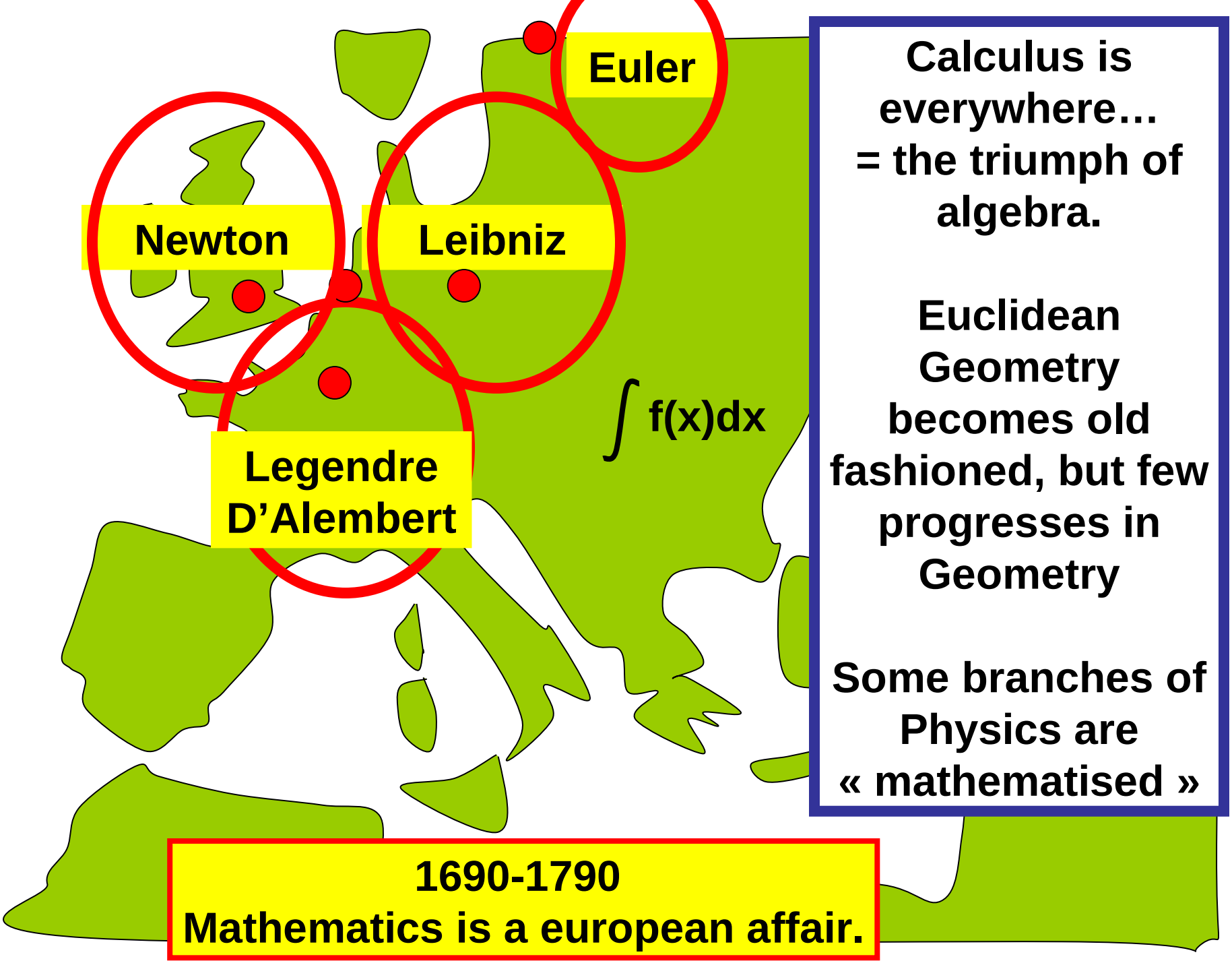
- Algebra : solution of polynomial equations, Complex numbers…


French period 1550-1700
1) Birth of algebra,
2) Analytic geometry :
Geometry can be done
by algebra
Descartes
Viète,
Fermat,
Pascal
« Royal Society »
1660
« Académie des
Sciences » : 1660

FRANCE :

- **Analytical geometry**
(Descartes 1640, pupil of the jesuits).

- **Beginning of a renewal of geometry, with the first new geometrical theorems that were not to be found in the greek fathers (e.g. Pascal's theorem, Desargues).**



Calculus is everywhere… = the triumph of algebra.

Euclidean Geometry becomes old fashioned, but few progresses in Geometry

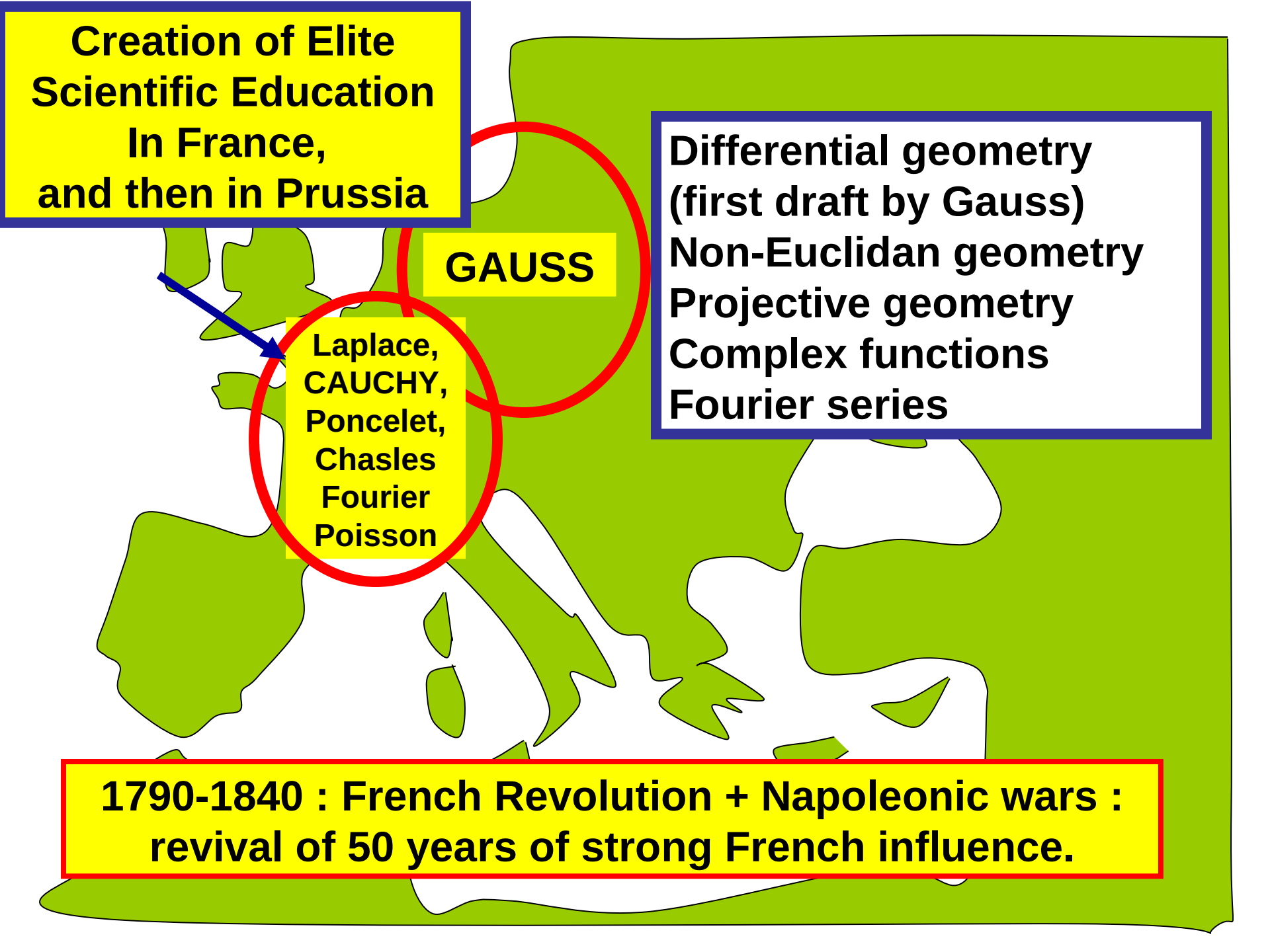
Some branches of Physics are « mathematised »

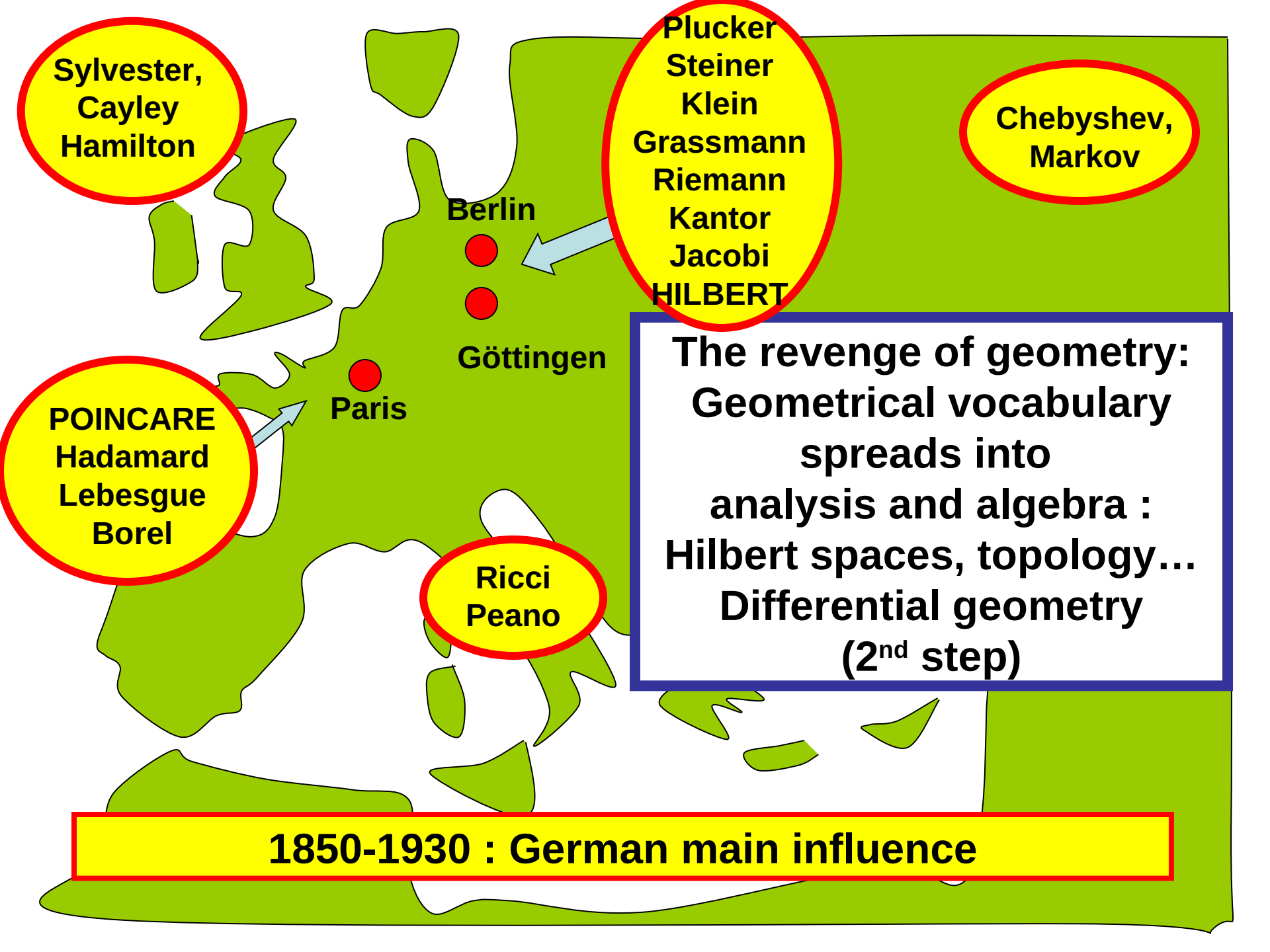
1690-1790
Mathematics is a european affair.

Following the advice of Huygens, who was in Paris, Leibniz became interested in mathematics, during his 4 years stay as a diplomat there.

Newton had very geometrical ideas, while building a revolutionary work, Universal Attraction, based on very few principles.

Analysis was born : it was the triumph of algebra. « Classical Geometry » was put at the background.


Creation of Elite Scientific Education In France, and then in Prussia
GAUSS
Laplace,
CAUCHY,
Poncelet,
Chasles
Fourier
Poisson
Differential geometry
(first draft by Gauss)
Non-Euclidan geometry
Projective geometry
Complex functions
Fourier series
1790-1840 : French Revolution + Napoleonic wars :
revival of 50 years of strong French influence.


Sylvester,
Cayley
Hamilton
Plucker
Steiner
Klein
Grassmann
Riemann
Kantor
Jacobi
HILBERT
Chebyshev,
Markov
Berlin
Göttingen
Paris
POINCARE
Hadamard
Lebesgue
Borel
Ricci
Peano
The revenge of geometry:
Geometrical vocabulary
spreads into
analysis and algebra :
Hilbert spaces, topology…
Differential geometry
(2nd step)
1850-1930 : German main influence

f ⊥ g
« A function
Is orthogonal to another »

Einstein (whose maths come from the Minkowski's lectures in Zurich) : « the curvature of the Universe… »