2020-09-30



# Late Medieval Mathematics

## Jordanus Nemorarius (Giordano of Nemi)

- lived and worked maybe late 1100s - to mid-1200s
- almost no biographical information
- his works were catalogued in a list that was compiled somewhere between 1246 & 1260.

Published works on several topics:

- practical arithmetic (revised, renamed, republished several times)
  - algorithms for common operation
- "theoretical" arithmetic - tried to do for arithmetic what Euclid did for geometry
  - axiomatic development, propositions all have proofs [many proofs have details left to the reader]
  - uses letters to represent generic numbers & unknowns [style somewhat similar to Diophantus]
- algebra - anticipates the idea of writing out the equation [in words] and then manipulating it to solve for the unknown.
- geometry, stereographic projection
- mechanics - uses the idea of forces and splitting them into components

The 1300s were not good for Europe.

Climate change: Medieval warm period ended, diminishing crop yields (eg famine 1317).

"Black Death": Bubonic plague arrived in Europe (Italy) in 1347, by ship from Crimean Peninsula on the Black Sea. [Actually started in what is now northern China in the 1330s, and traveled along trade routes & via nomads moving around across Central Asia.]

Believed to have killed over 25% of the population in Europe (more than 50% in some areas).

There were enormous economic dislocations and a depression that lasted for generations.

One consequence was a loosening of feudal ties,

another was a search for greater efficiency in many areas

(Innovations in bookkeeping, technology [better plows, better guns].)

# Nicole Oresme (c 1320 - 1382)

- a Frenchman who entered the Church and became a royal advisor and bishop
- wrote on mathematics, economics, physics, astronomy, philosophy, theology, music, education, etc

1° Wrote on the theory of proportions

(De proportionibus proportionum and Algorismus proportionum)

- gave rules for handling powers & exponents & allowed for the possibility of irrational exponents
- suggested notation for handling fractional powers

| | |
|---|---|
| p | 1 |
| 1 | 2 |

denotes the "one and one-half" proportion

i.e. $x^{3/2} = \sqrt[4]{x^3} = \left(\sqrt{x}\right)^3$

and $\frac{1 \cdot p \cdot 1}{4 \cdot 2 \cdot 2}$ for $\left(2\tfrac{1}{2}\right)^{1/4}$

2° First cut at graphing functions using a coordinate system ["latitude" vs "longitude"]

(Tractatus de latitudinibus formarum ("Work on forming latitudes")

& Tractatus de figuratione potentiarum et mensurarum

("Work on figures")

- the idea of function & the idea of its graph [even extended it to 3-D]

- finding areas under the graph.

3° Worked series & limits (especially in geometry)

(Tractatus de configurationibus qualitatum et motuum

("Work on qualitative analysis & motion")

& Questiones super geometriam Euclidis

("Question in Euclid's geometry")

- formulas for sums of various series & limits

- proved that the harmonic series diverges.

Next time: Renaissance.