
Analogic computer on paper

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Analog computer for solving the Pythagorean theorem graphically

The graphic approach based on Jacob's rod was mathematically impeccable and strategically for medieval nautical.

Input data

Vertical leg (?-Latitude): It represented the difference in latitude sailed in degrees ($1^\circ \approx 17.5$ leagues).

Angle (?): The fourth course with respect to the meridian (11.25° , 22.5° , 33.75° , etc.).

Data obtained

Hypotenuse (d): The total distance sailed in leagues ($d = \frac{\Delta \text{Lat}}{\sin \theta}$).

Horizontal leg (?-Longitude): The apartment or distance ($a = \Delta \text{Lat} \cdot \tan \theta$).

Advantages in medieval and Renaissance navigation

He avoided mathematical calculations of the pilot: Sailors did not need to have trigonometric tables or multiply complex numbers in the logbook; it was enough to know how to use a compass of points to measure directly on the graphic drawing.

Using the compass of points (sesta): Projecting the value of latitude onto the vertical axis and looking for the intersection with the heading line (the corresponding hypotenuse), the pilot simply opened the compass between the origin and the cut-off point. He then transferred this opening to the nautical chart (to the "trunk of leagues") to mark the estimated point.

Parallelism with Jacob's rod of Jacob ben David ben Gerson: Jacob's rod transformed angular reading into a physical length by proportionalizing similar triangles ($\tan \theta$ and $\sin \theta$). Translating this same geometric logic to a nomogram or "computer on paper" avoided both complex numerical tables and manual calculations on the high seas.

It is a coherent explanation to demonstrate how nautical science solved the resolution of right triangles in a purely graphic and analogic way.