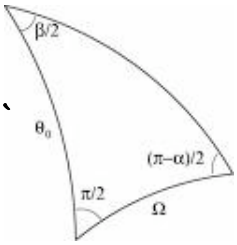
## GREECE
## `310BC-100AD`




Archimedes (ca. 287-212 B.C.) -

-Two extant works are devoted to geometry of three dimensions-

On the Sphere and Cylinder & On Conoids and Spheroids proved that the area of a sphere equals four times that of a great circle & the volume and surface of a sphere equals two-thirds that of the cylinder that inscribes it[3]

Eratosthenes (ca. 276 B.C.)-

Measurement of the Earth

His calculation was within 1% of current measurement[1]

Menelaus (ca. A.D. 100)-

-First appearance of a definition for a spherical triangle in Sphaerica: 3 Book treatise develops spherical trigonometry of the times-

## ARABIAN PENINSULA
## '1000-1250 AD'

Abu al-Wefa al-Buzjani (ca. 1000)-

-Discovers Law of Sines for Spherical Triangles

al-Jayyani (ca. 1060)-The Book of Unknown Arcs of a Sphere

-Spherical Trigonometry brought to modern form-

Nasir ed-din (ca. 1250)-

-First work on plane and spherical trigonometry considered independently of astronomy-

The works of these mathematicians introduced Western Europe to modern spherical trigonometry[4]

## EUROPE
## '1250-1600'

Rise of the Christian Schools-

Early universities reserved for educating priesthood

Geometry plays minor role: Used for surveying[3]

## EUROPE
## 'CA 1600-1850'



Napier (ca. 1600)-

Napier's Circle (pictured)

How it works

Napier's Logarithm Tables allow complex spherical trigonometric equations to be solved in a fraction of the time originally required

Royal Observatory at Greenwich England (1665)-

-Founded to calculate the geographic position of heavenly bodies-

These positions allowed sea captains to determine their location anywhere on the globe using the sextant and spherical trigonometry

Navigation and Spherical Geometry

(Modern Sextant)


Rise of Universities-

-Practical need for study of warfare, navigation, and astronomy requires knowledge of spherical geometry-

-Printing press allows math texts to become affordable and available in many languages[3]-

Scroll through a spherical trigonometry text from 1833

## NORTH AMERICAN SCHOOLS 'CA 1900-PRESENT'

Plane geometry was not required for admission to Harvard and Yale until the last half of the 19th Century[3]

A Call for Spherical Geometry (ca. 1940)-

-World War II illustrates a lack of spherical geometry education as American soldiers train to be pilots, navigators, gunners, and officers-

-Learning solid geometry is called a "patriotic duty" and it returns to high school curricula[5]-

"Spherical Trigonometry should be taught solely on its merits and not because it is needed in wartime emergency"[6] –Prof. McClennon, Grinnell College (1943)-

Spherical Geometry Excluded From Curricula (ca. 1970)-

-Computers simplify spherical trigonometric computations and eliminate the need to understand formulas and their derivations. Textbooks become rare[7]-

-Subjects that cease to be taught in universities will not be taught in lower grades[8]

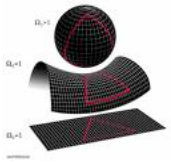
"Ease of computation should lead to an emphasis on theory"-Dr. Watkins San Jose State University[7]-

## GLOBAL PERSPECTIVES 'CA 1900-PRESENT'

Spherical Rigidity (ca. 1899)

-Any surface in 3-space with the same intrinsic geometry as a sphere, must be a sphere[12]-

This is useful when determining "shape" from a known geometry

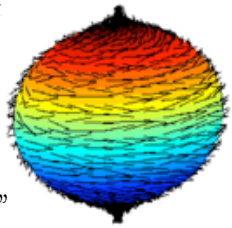


Albert Einstein (ca. 1917)

-Relativity theory consistent with a spherical universe[9]-

Hairy Ball Theorem (Present)

-Essentially: "It is impossible to comb the hairs on a sphere flat without producing a cowlick"



This theorem is used in computer graphic 3-D imaging where the "hairs" are vectors orthogonal to the surface of the sphere[10]

Spherical Harmonics (Present)

-Describe vibrations on a sphere-

-Applications in seismology and quantum mechanics-

Spherical Harmonics explains why a tidal wave that struck Martinique returned to the same area without being observed anywhere else[11]

Isoperimetric Inequality on a Sphere (Present)

-Relates area, volume, and their higher-order counterparts enclosed by a perimeter to the length of the perimeter…these "volumes" are maximized when the perimeter is a sphere-

This inequality explains why a drop of water takes the shape of a sphere[13]

Poincare Conjecture (Present)

-Essentially: If a loop on a surface can be "tightened" to a point, then that surface is a sphere-

This was not proved until 2006, a century after it was proposed[14]

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