Later Greek Mathematics

Around 300 BC, mathematical activity moved to the Egyptian part of the Greek empire. **Alexandria** became the intellectual centre for Greek scholarship for more than 800 years, with its famous library containing more than a half-million manuscripts. The Pharos lighthouse at Alexandria was one of the seven wonders of the ancient world.

The first important mathematician associated with Alexandria was **Euclid** (c. 300 BC), who is primarily remembered for his *Elements*, the most influential and widely read mathematical text of all time. It consists of thirteen books on arithmetic, number theory, and plane and solid geometry. A model of deductive reasoning, the text starts from initial axioms and deduces new propositions in a logical and systematic order.

Archimedes (c. 287–212 BC), a native of Syracuse on the island of Sicily, studied levers, invented the Archimedean screw for raising water, and devised ingenious mechanical contrivances

for the defence of Syracuse. In statics, he formulated “Archimedes’ principle” describing the weight of an object immersed in a liquid. In geometry, he calculated the surface areas and volumes of the spheres and cylinders, and he listed the thirteen semiregular solids. He investigated the “Archimedean spiral” with polar equation $r = k\theta$, and he determined (by considering 96-sided polygons) that π lies between $3^{10/71}$ and $3^{1/7}$.

Hipparchus of Bithynia (190–120 BC), possibly the greatest astronomical observer of antiquity, discovered the precession of the equinoxes, introduced a coordinate system for the stars, and constructed a star catalogue. Sometimes called “the father of trigonometry,” he constructed a “table of chords” yielding the sines of angles.

The earth-centred hypothesis of planetary motion, developed by Claudius **Ptolemy** of Alexandria (c. 100–178 AD), became known as the *Ptolemaic system*. Ptolemy’s influential thirteen-volume work on astronomy, usually called by its later Arabic name *Almagest*, provided a mathematical description of the motion of the sun, moon, and planets, and it included a table of chords showing the sines of angles from 0° to 180° in steps of $\frac{1}{2}^\circ$. His *Geographia* on map-making, containing various types of map projections and listing the latitude and longitude of 8000 places in the known world, was used by navigators for many centuries.

Alexandria

Euclid

Archimedes

Archimedes’ law of the lever

Hipparchus

Ptolemy

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