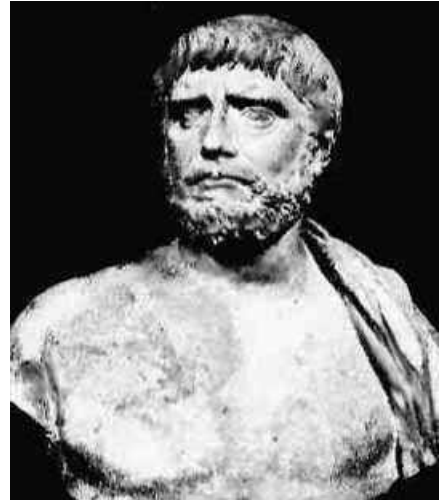


Thales

Thales of Miletus (c. 624 – 548 BCE) is considered the founder of Greek descriptive mathematics and the first Greek philosopher of historical record. He is reputed to have been a pioneer (perhaps even the pioneer) in seeking the general principles underlying nature, thus becoming the first natural philosopher, that is, physicist. He may be considered the inventor of scientific methodology as well as the originator of the Golden age of Greek enlightenment. His



investigations marked the beginning of what has become known as Western thought. Reportedly he gave the first demonstrations of various geometric theorems, thus creating the deductive basis of the science. Unfortunately there are no copies of any of his writings and no contemporary sources exist. What is known about him and his work is provided by the questionably accurate commentaries written as much as a thousand years later.

Herodotus says that Thales was of Phoenician descent, but his mother was Greek. He was born at Miletus in Asia Minor, the primary city of the Ionian coast, which is now part of Turkey. It was at Miletus that Thales founded the Ionian School, the first of its kind in Greece. Some scholars believe that Pythagoras attended Thales' school. Thales took part in the political life of Ionia and advocated the federation of Ionian cities of the Aegean region. He also built large engineering works and devised instruments for calculating distances. Aristotle reported that Thales believed that the Earth and all things on it had once been water and that evaporation and condensation were the universal processes that changed all things. What made his explanations different from his predecessors is that it was the first to account for phenomena in “natural” rather than supernatural terms.

Thales pioneered later Greek science by attempting to derive theories from observed facts. In *Protagoras*, Plato wrote, “A man’s ability to utter such remarks [notable, short, and compressed] is to be ascribed to his perfect education. Such men were Thales of Miletus, Pittacus of Mytilene, Bias of Priene, Solon of our city [Athens], Cleobulus of Lindus, Myson of Chen, and, last of the traditional seven, Chilon of Sparta.... And you can recognize that character in their wisdom by the short memorable sayings that fell from each of them.” Thales was the first of this group that became known as “The Seven Sages of Ancient Greece.” When Thales was asked what was most difficult, his reply was, “To Know Thyself.” Asked what was very easy, he answered, “To give advice.”

Early in life Thales was a merchant who traveled widely in Crete, Asia and Egypt where he studied astronomy and geometry. It wasn’t until his middle age that he returned to Miletus, having accumulated sufficient wealth to retire from business and public life to turn his attention to the study of philosophy and science. A millennium later, Proculus wrote:

“[He] first went to Egypt and thence introduced this study (geometry) into Greece.

He discovered many propositions himself, and instructed his successors in the principles underlying many others, his method of attack being in some cases more general (i.e. more theoretical or scientific), in others more empirical (i.e. more in the nature of simple inspection or observation.)”

Thales was the first of the Greeks to take an interest in mathematics for its own sake, and not merely for some practical use. He considered geometrical figures as abstractions rather than real-world objects. Iamblichus of Chalcis reported that Thales defined number as a system of units and that his notion of unity came from Egypt. In astronomy, Xenophanes claimed that Thales predicted the solar eclipse that so frightened the combatants that it stopped a battle between the Lydians and the Medes, most likely on

May 28, 585 BCE. His prediction seems to confirm that he had access to Babylonian records. He gave the length of the year as 365 days, something he no doubt learned from the Egyptians. He is credited with discovering the inequality of the four astronomical seasons, the four parts of the tropical year divided by the solstices and equinoxes. Thales believed in a “first principle”, that is, a God who caused everything, teaching:

“Of all things that are, the most ancient is God, for he is uncreated; the most beautiful is the universe, for it is God’s workmanship; the greatest is Space, for it contains everything; the swiftest is Mind, for it speeds everywhere; the strongest is Necessity, for it masters all; and the wisest Time, for it brings everything to light.”

Some passages in Aristotle’s writings suggest that Thales believed the earth was spherical. Thales certainly would have observed that the earth has the appearance of being curved. Through astronomical observations and watching the risings and settings of the sun during work on fixing the solstices, he could have noticed that stars that are visible in a certain place in the sky are not visible further to the north or south. Thales may have realized that this and many other natural phenomena could be explained only with the assumption of the earth as a sphere.

Thales is explicitly credited with the formulation of five theorems. He did not prove these propositions in any formal sense. According to Proclus, Thales “attacked some problems in a general way and others more empirically.” His “proofs“were by inductive demonstration, and if his experiments all resulted in the same outcome, he felt confident that his arguments were valid. He experimentally “proved” that the base angles of an isosceles triangle are equal by taking another exactly equal isosceles triangle, turned it over and superimposed it on the first. He believed it obvious that if two lines intersect, the vertically opposite angles are equal.

Proculus stated that in his history of geometry, Eudemus attributed the following theorem to Thales: “If two triangles have the two angles equal to two angles respectively, and one side equal to one side, namely, either the side adjoining the equal angles, or that subtending one of the equal angles, they will have the remaining sides equal to the remaining sides and the remaining angle equal to the remaining angle.” Eudemus said that Thales used this theorem to determine the distance to ships at sea. Diogenes Laertius wrote, “Hieronymus informs us that [Thales] measured the height of the pyramids by the shadow they cast, taking the observations at the hour when our shadow is the same length as ourselves.” Although the Great Pyramid of Giza was 2000 years old when he visited Egypt, its height was not known.

The following tales about Thales are likely apocryphal, but one should never allow the truth to get in the way of a good story, especially if it is related by W.W. Rouse Ball in *A Short Account of the History of Mathematics*. Once Thales was transporting salt loaded on a team of mules. At one point during the trip one of the animals slipped into a stream. The water caused some of the salt to dissolve, making the beast’s burden lighter. The animal was a quick learner and from then on every time it carried a load of salt it rolled over into a stream at each opportunity. To break the animal of this habit, Thales loaded the mule down with rags and sponges. When the mule rolled around in the next stream its load became heavier and it was cured of its bad habit.

Aristotle tells of a time when there was the prospect of an abundant crop of olives. Thinking ahead Thales got possession of all the olive-presses in the district, and having “cornered” the market, set his own terms for renting the presses out to olive harvesters. Socrates also related a story about Thales. One evening so engrossed in observing the heavens as he wandered about, he fell into a well. While he was being fished out, a woman who saw what happened, commented, “Here is a man who would study

the stars and cannot see what lies at his feet.” Thales died of heat exhaustion while attending an athletic event. The inscription of his tomb reads, “Here in a narrow tomb great Thales lies; yet his renown for wisdom reaches the skies.”

Quotation of the Day: “I will be sufficiently rewarded if, when telling it to others, you will not claim the discovery as your own, but will say it was mine.” – Thales’ response when he was asked what he would take for one of his discoveries.