

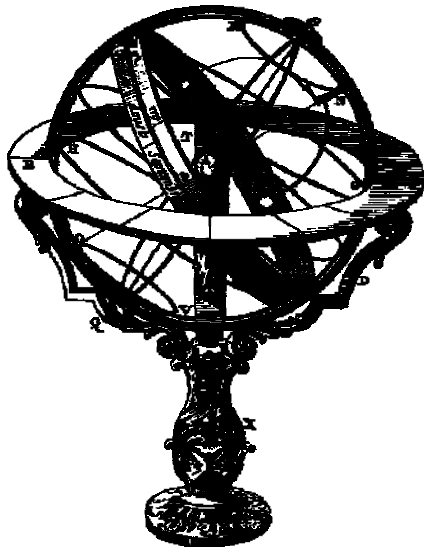
ERATOSTHENES OF CYRENE

Because International year of astronomy 2009, probably many people have heard of him. A Greek mathematician, poet, athlete, geographer and astronomer called Eratosthenes was born in Cyrene (in modern-day Libya), in 276 BC and died in 195 BC. He was the third chief librarian of the Great Library of Alexandria, the center of science and learning in the ancient world, and died in this city. He was never married.



Eratosthenes studied in Alexandria and claimed to have also studied for some years in Athens. He made several important contributions to mathematics and science, and was a good friend to Archimedes. His contemporaries nicknamed him Βῆτα (*beta*, the second letter of the Greek alphabet) because he supposedly proved himself to be the second best in the world in almost any field.

Eratosthenes criticised Aristotle (c. 384 - c. 322 BC) for his blind chauvinism because he had argued that humanity was divided into Greeks and everyone else, whom he called barbarians, and that the Greeks should keep themselves racially pure.



Hipparchus (c. 190 BC – c. 120 BC), credited Eratosthenes as the inventor of the armillary sphere, which was widely used until the invention of the orrery in the 18th century. It was used to demonstrate the motion of the stars around the Earth. Before the advent of the European telescope in the 17th century, the armillary sphere was the prime instrument of all astronomers in determining celestial positions.

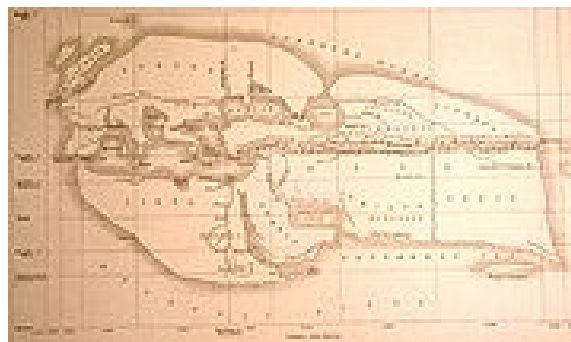
He also created a map of the world based on the available geographical knowledge of the era. Eratosthenes was also the founder of scientific chronology; he endeavored to fix the dates of political events from the conquest of Troy.

Eratosthenes also conceived the "Sieve of Eratosthenes", a method of identifying prime numbers. Made a list of all the integers less than or equal to n (and greater than

one). Stroked out the multiples of all primes less than or equal to the square root of n , then the numbers that were left were the primes.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

He made several discoveries and inventions including a system of latitude and longitude. He was the first to calculate the circumference of the Earth (with remarkable accuracy), and the tilt of the earth's axis (also with remarkable accuracy); he may also have accurately calculated the distance from the earth to the sun and invented the leap day (Although the modern calendar counts a year as 365 days, a complete revolution around the sun takes approximately 365 days and 6 hours. Every four years, as an extra 24 hours have accumulated, one extra day is added to keep the count coordinated with the sun's apparent position).



19th century reconstruction of Eratosthenes's map of the known world, c.194 BC.

ERATOSTHENES' MEASUREMENT OF THE EARTH'S CIRCUMFERENCE

Eratosthenes peered at noon and came up with the diameter and circumference of our planet. The summer solstice sun and a trip was all it took. He knew that on the summer solstice at local noon in the Ancient Egyptian city of Syene (in the modern day as Aswan) on the Tropic of Cancer, there was no shadow at all on the same day. That

meant the Sun was straight overhead. He found that at the same time, in Alexandria, Egypt, approximately 787 km due north of Syene, the angle of inclination of the sun's rays was about 7.2° . With these measurements he computed the diameter and circumference of the earth.

Since light rays travel parallel to each other, we get pairs of congruent angles. With the central angle measuring 7.2° and the length of the arc between Syene and Alexandria 787 km we can write the proportion:

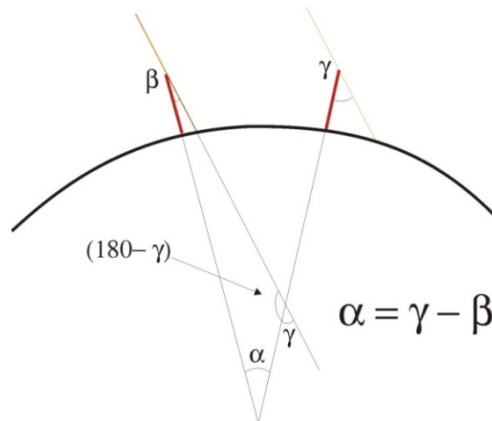
$$7.2 / 360 = 787 / X$$

therefore $X = 39350$ km, the circumference.

Procedure:

Find someone that is at least 500 km either due north or due south. We can use an atlas to measure the distance between them.

Drive a pole into the ground at a 90 degree angle. Measure the length of the pole from the ground to the topmost point. Monitor the pole at local noon, that is, when the shadow is smallest. Tell your partner to measure the sun's angle of inclination from the shadow cast by his pole.



Using the distance value and the measured angle, compute the circumference and diameter.



A commemorative gold and silver euro coin from Austria