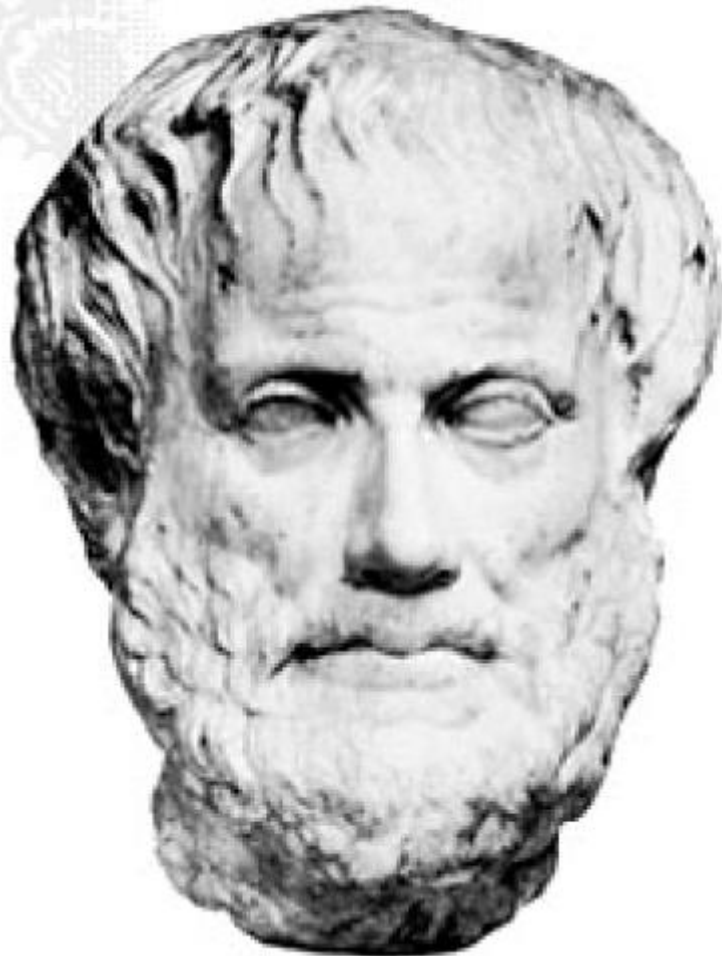


# SHAPE AND SIZE OF THE EARTH

COURSE INSTRUCTOR: MS. AMNA AFZAL



Aristotle,  
"On the Heavens,"  
Book II, Chapter 14  
350 B.C.E.  
(Before the Common Era)

“The earth is of a spherical shape. The evidence of the senses further corroborates this. How else would eclipses of the moon show segments shaped as we see them? As it is, the shapes which the moon itself each month shows are of every kind -- straight, gibbous, and concave -- but in eclipses the outline is always curved: and, since it is the interposition of the earth that makes the eclipse, the form of this line will be caused by the form of the earth's surface, which is therefore spherical.” -

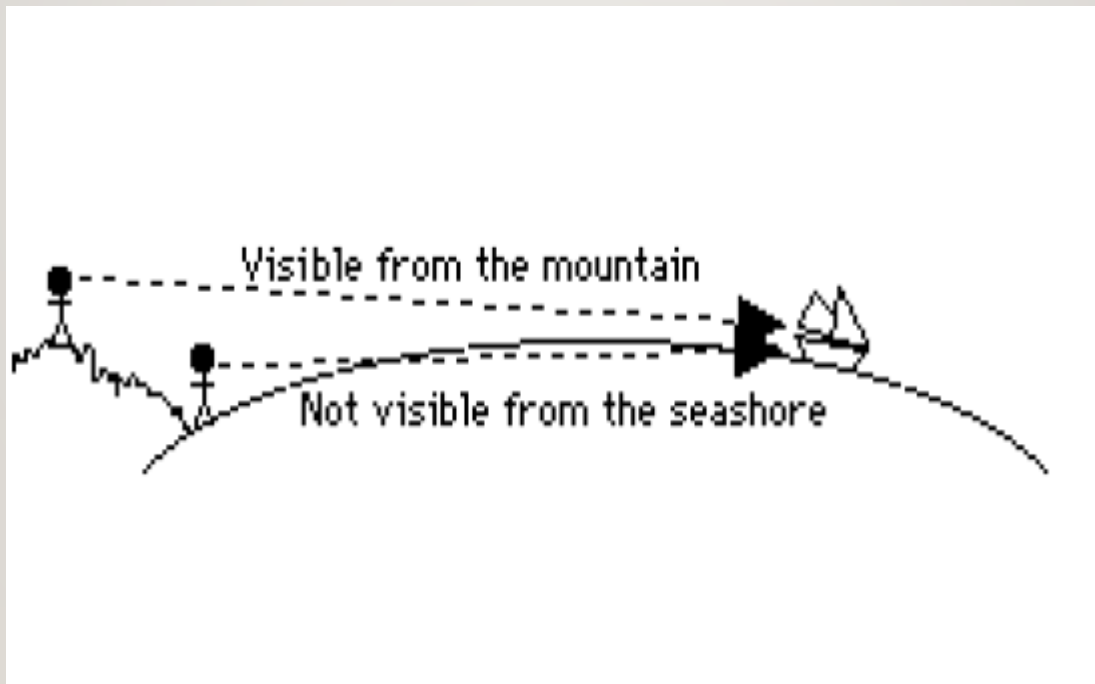
# EVIDENCE FOR THE SHAPE OF THE EARTH:



# THE EARTH IS CURVED

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- 1) Ships on the horizon appear to sail up hill when moving toward you and down hill when moving away.



# THE EARTH IS DISK SHAPED

- 1) The shape of the earth's shadow as the moon moves through it during an eclipse.
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# THE EARTH IS A SPHERE

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- 1) The North star stays stationary over the north pole.
- 2) The angle of polaris above the horizon changes as the observer moves north from the equator.

**And the #1 evidence.....**

**SATELLITE PHOTOS**

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# THE TRUE SHAPE OF THE EARTH IS AN OBLATE SPHEROID.

Slightly flattened at the poles and slightly bulging at the equator.

- 1) Evidenced by gravity: Objects weigh slightly less at the equator than at the poles, therefore we infer objects at the poles are closer to the center of the earth.
- 2) The force of gravity is not at true vertical at every location on earth.



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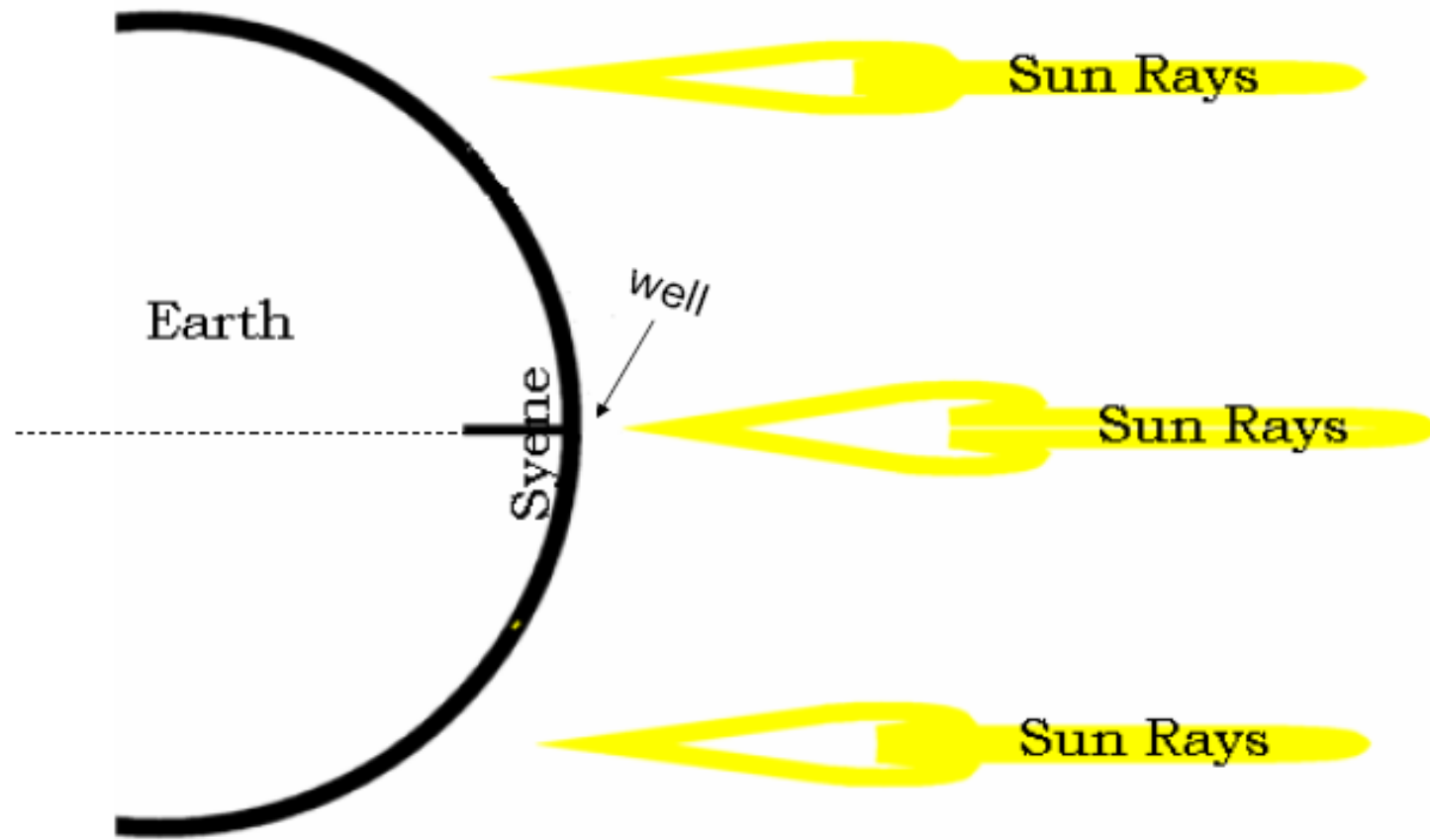
Eratosthenes (276-195 BCE) – Librarian of the  
Aristotle Library at Alexandria, Egypt



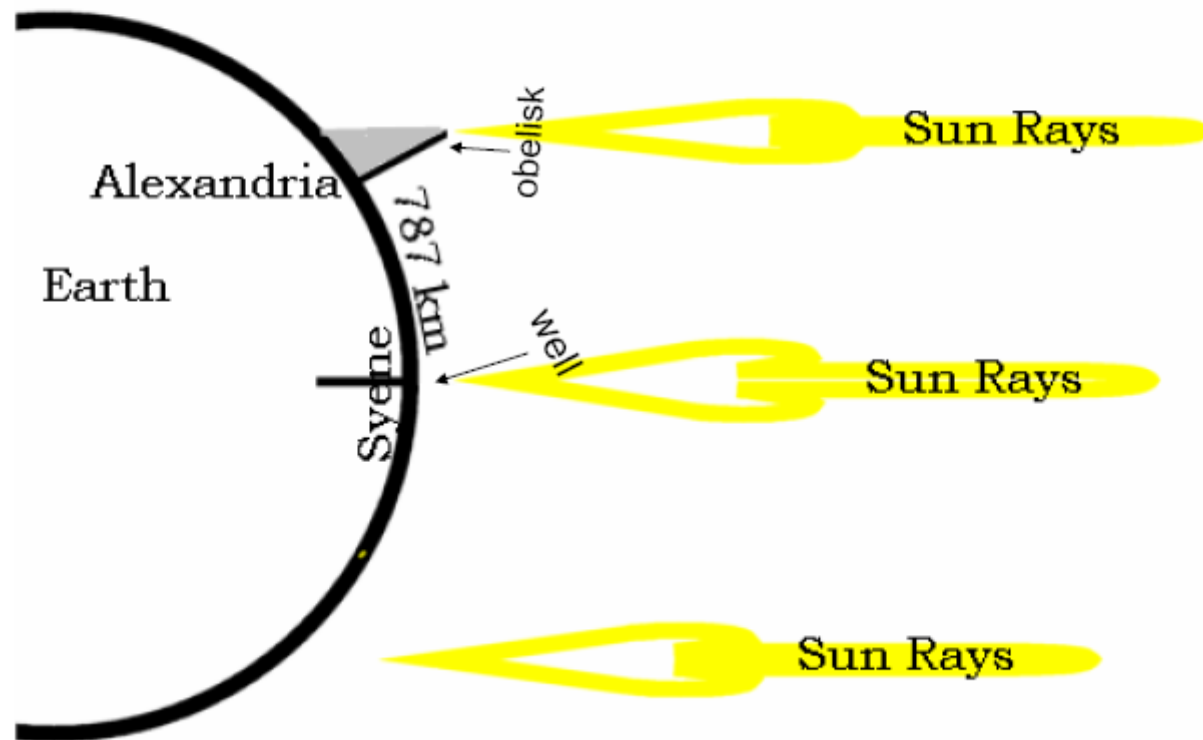
First to calculate the  
circumference of the  
earth with a fair  
amount of accuracy.

How could the circumference of the earth be calculated over 2000 years ago without the assistance of satellites or computers?

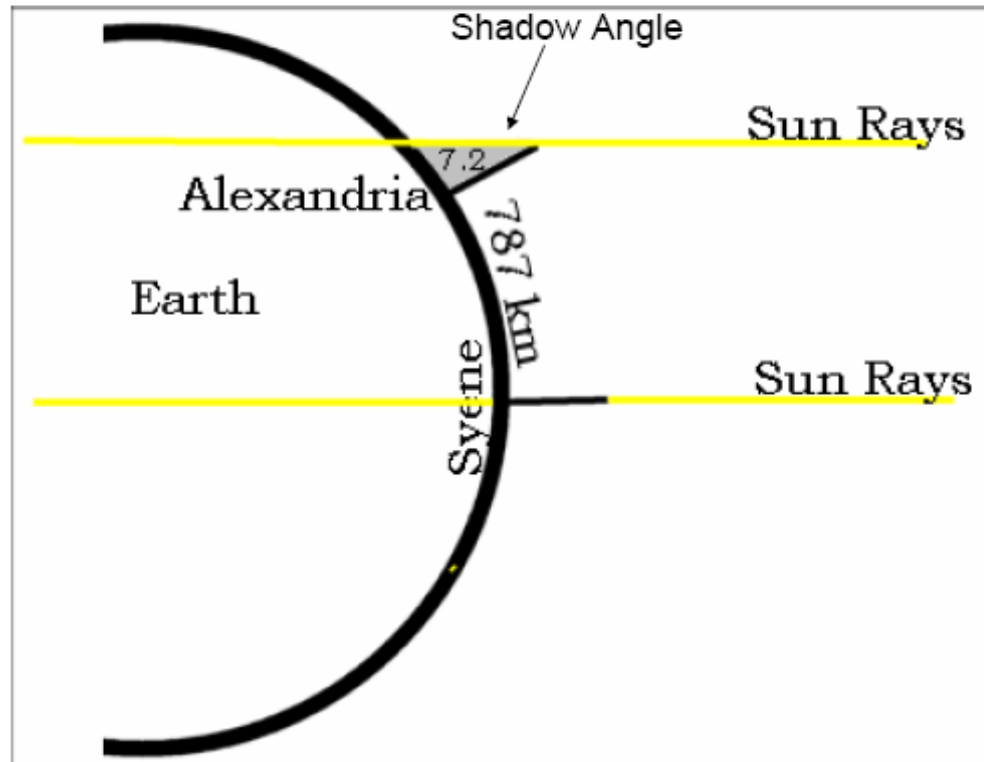
Eratosthenes made a remarkably precise measurement of the size of the earth. He knew that at the summer solstice the sun shone directly into a well at Syene, Egypt at noon.



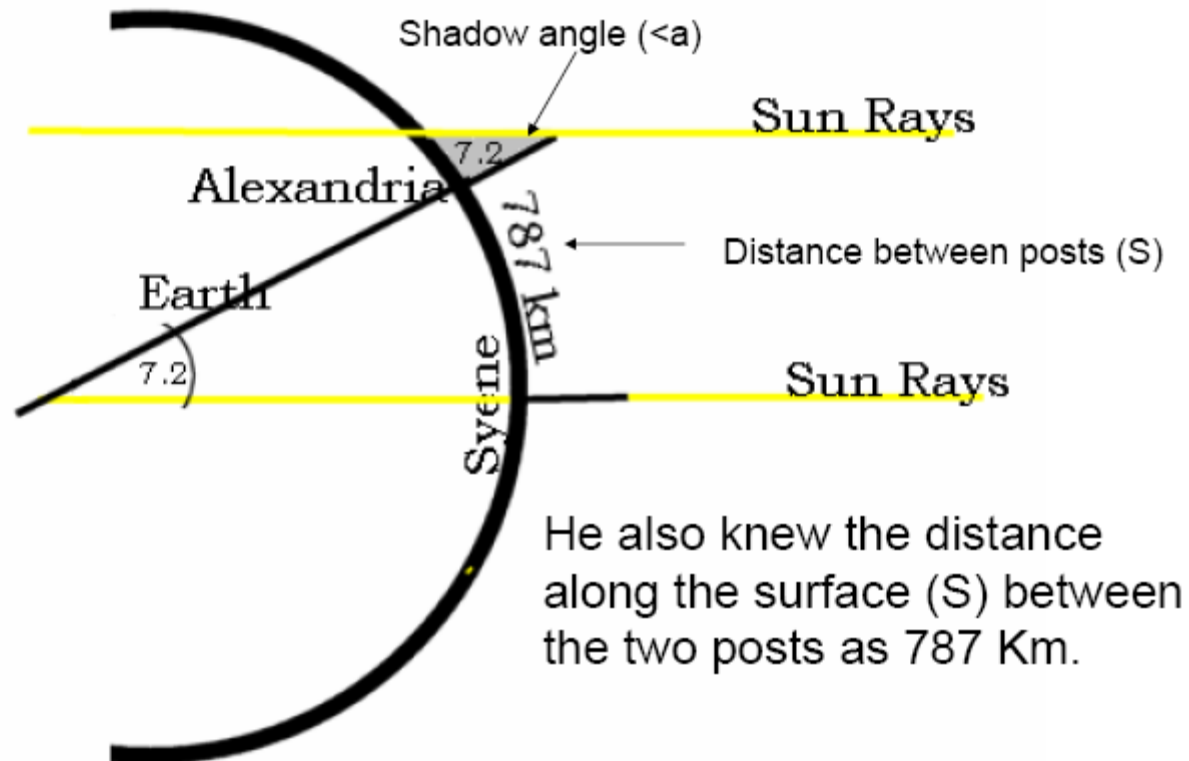
He found that at the same time, in Alexandria, Egypt, approximately 787 km due north of Syene (now Aswan), vertical posts cast shadows and a well in the center of town only reflected a partial view of the sun's image on the same day.



He measured the angle of the shadow cast by a vertical post placed in the ground next to the well at  $7.2^\circ$  and called this the *shadow angle* ( $\angle a$ ). He assumed the sun's rays to be parallel when they strike the earth so he imaged the rays as two parallel lines passing through the earth at both locations.



If he extended a line from the post in Alexandria to the center of the earth across the two parallel lines alternate interior angles would be formed at the post shadow and at the center of the earth.



# So...

He calculated the shadow angle to be  $7.2^\circ$   
as a portion of the entire  $360^\circ$  circumference of the earth,

$$\frac{7.2^\circ}{360^\circ} = \frac{787 \text{ Km}}{C}$$

And that the distance between the two wells was  $\sim 787 \text{ km}$

And that this distance was a portion of the entire  
circumference (C) of the earth...

What is the circumference of the earth as measured by Eratosthenes?

$$\frac{7.2^\circ}{360^\circ} = \frac{787 \text{ Km}}{C}$$

Actual circumference of the earth = 39940.8 Km

Calculate his percent error.