

The Eratosthenes experiment: calculating the Earth's circumference

Introductory activity

Who was Eratosthenes? Why is his experiment still important today?

A presentation in class, about Eratosthenes, would be ideal to inform students about his life, the era during which he did his experiment, what helped him to reach to his conclusions, and the way he managed to accomplish his experiment. The purpose of this activity is for students to realize the importance of the Eratosthenes experiment and should be done days before you make your own measurements in the schoolyard. Tell your students that many schools are doing this experiment on this specific day.

Materials

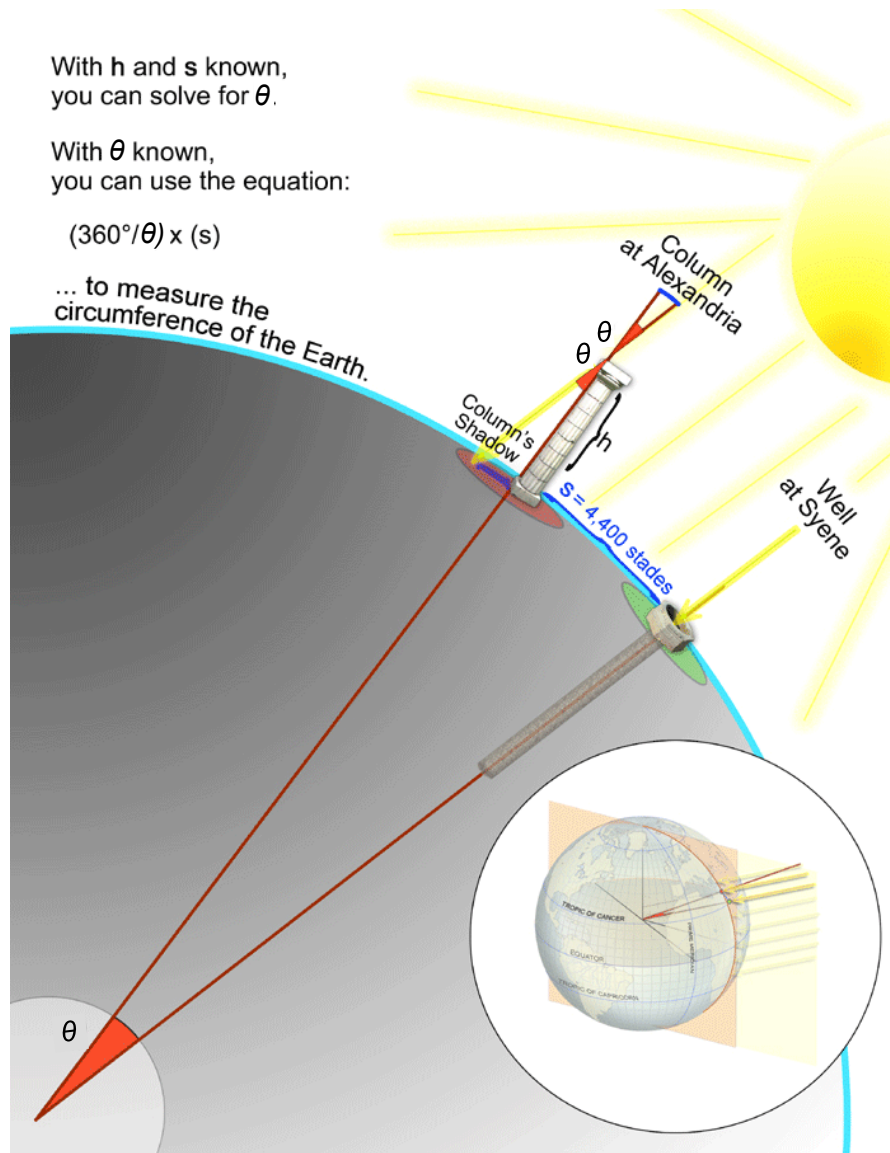
- Internet connection and a suitable device (PC, laptop, tablet, smartphone)
- Globe
- Plasticine
- Two thumbtacks
- Flashlight

Alternatively, you can just use the globe, plasticine, and the thumbtacks, and you can be the narrator to talk about Eratosthenes and his experiment.

Procedure

- Tell your students about Eratosthenes.
- Explain to them that the experiment they are going to perform is one of the most important experiments of the ages.
- Watch a [video](#) with your class about his life and his work on astronomy, mathematics, geography, philosophy, and poetry, with Carl Sagan as a presenter.
- Explain to your students who Carl Sagan was.
- Use the globe and mark on it with the plasticine and thumbtacks the two cities used by Eratosthenes, Alexandria and Syene (nowadays Aswan).
- Using the flashlight, show your students what equinox and summer and winter solstices mean, by illuminating the equator, the Tropic of Cancer, and the Tropic of Capricorn, respectively.
- Explain to your students when Eratosthenes did his experiment and that he couldn't have managed to succeed if Aswan wasn't on the Tropic of Cancer.
- Show your students the scheme and the geometry of the experiment. Additionally, you can draw the scheme on the board. This way, students will realize how Eratosthenes was thinking.
- Give particular significance to the assumptions made by Eratosthenes: 1) the Earth is spherical, and 2) sunrays falling on the Earth are practically parallel.

- Inform your students how Eratosthenes measured the distance from Alexandria to Syene, and how we know about his measurements today.



Geometry of the experiment

Image: NOAA Ocean Service Education/[Flickr](#), [CC BY 2.0](#)

- Give your students the answers to Eratosthenes' experiment, which he managed to measure at about 7° , which is 1/50th of the entire circle.
- Guide them to make a simple analogy to find the total circumference of the Earth, according to Eratosthenes.
- Give your students time to understand what Eratosthenes did.
- Explain to them what they are going to do on the day of the equinox.



After completing the introduction to Eratosthenes and his experiment, ask students to answer the following questions:

- 1) Eratosthenes' experiment originally took place
 - a) On 21 June, during the summer solstice
 - b) On 20 March, during the spring equinox
 - c) On 21 December, during the winter solstice
 - d) On an unknown day, during summer

- 2) When Eratosthenes did his experiment
 - a) He was head of the Library of Alexandria
 - b) He was working for the Pharaoh
 - c) He was with Socrates in Athens
 - d) He was the King of Egypt

- 3) Assuming that sunlight comes from afar, Eratosthenes' experiment can be the basis for concluding that
 - a) The Earth is flat
 - b) The Earth is not flat
 - c) The Earth is the centre of the cosmos
 - d) The Earth rotates around the sun

- 4) If Eratosthenes lived in the southern hemisphere, which two cities (instead of Alexandria and Syene) could he use for a successful experiment? Why? Explain. (You can use the globe to find the cities or Google Earth.)

- 5) If Eratosthenes lived in Europe, which two cities (instead of Alexandria and Syene) could he use for a successful experiment? Why? Explain. (You can use the globe to find the cities or Google Earth.)
