

The Eratosthenes experiment: calculating the Earth's circumference

Eratosthenes experiment – worksheet

Before the experiment

- To carry out the experiment, it is necessary to
 - find the exact time for the experiment (zenith or culmination time) at our location
 - determine the distance of our school from the equator
- We find the time when the Sun is at the zenith with the help of the [SunCalc](#) web2.0 tool.
 For (name of the school): Experiment date _ / _ / 20_ _ , the **zenith time** is _ : _ .

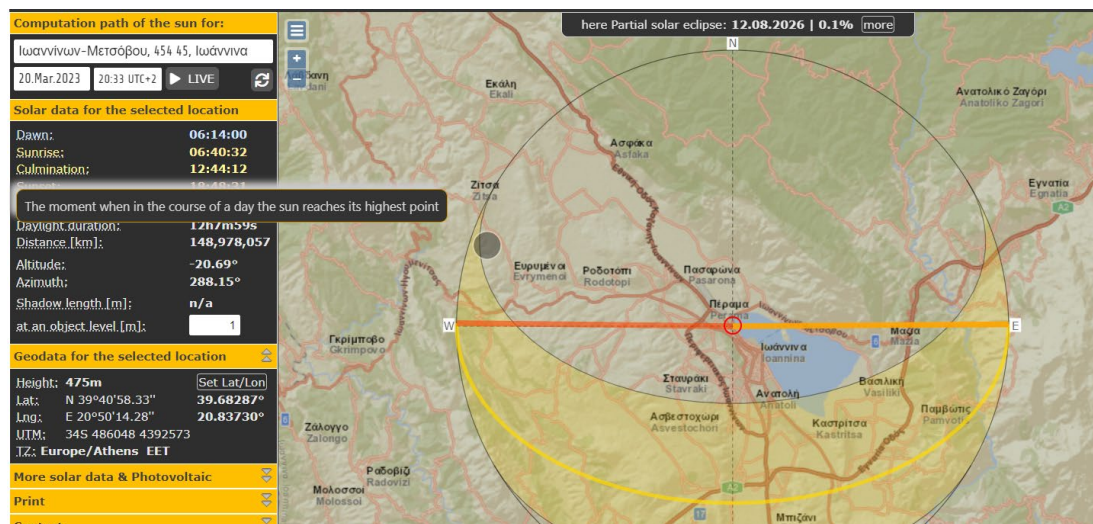


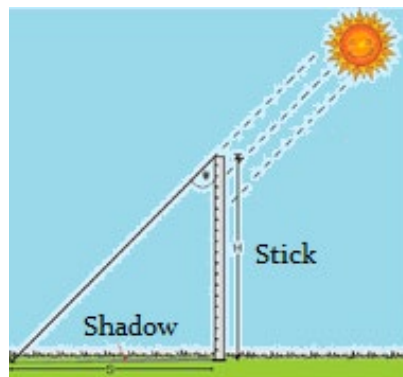
Image: SunCalc.org ©Torsten Hoffmann 2015–2023

3. To find the distance from our school to the equator, we use Google Maps (or Google Earth).
Distance (d) → equator (along the same meridian): km.



During the experiment

Stick height (h)	h : cm
Shadow length (s):	s : cm



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After the experiment

With h and s known,
you can solve for θ .

With θ known,
you can use the equation:

$$(360^\circ/\theta) \times (s)$$

... to measure the
circumference of the Earth.

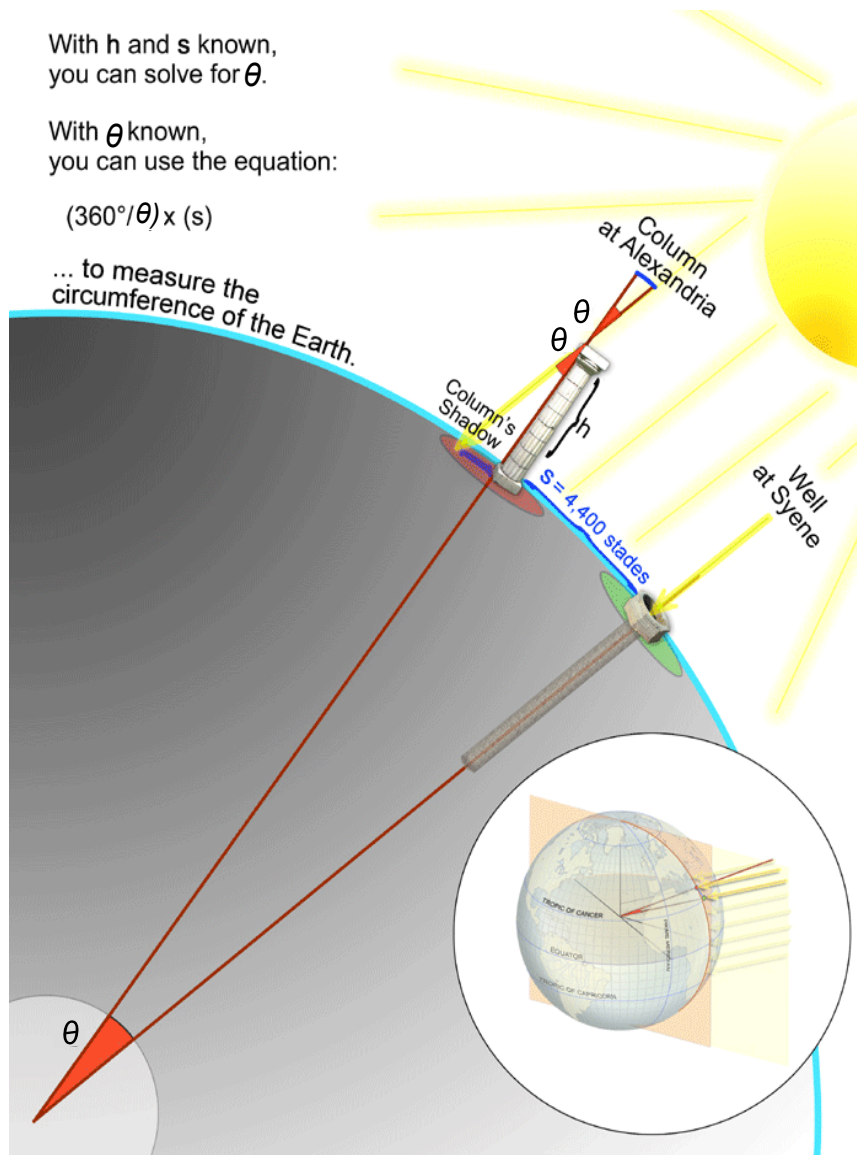


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- Using trigonometry, calculate the tangent of the angle θ , and then the angle (you can use a scientific calculator).
- Then use the angle θ and the measured distance from the equator (d) to calculate the Earth's circumference (C).

Calculations

$$\tan \theta = \frac{s}{h} = \text{---} = \dots\dots\dots \quad \text{so} \quad \theta = \dots\dots\dots^\circ$$

$$\frac{d}{\theta} = \frac{C}{360} \quad \text{so} \quad C = \dots\dots\dots$$

- Eratosthenes measured the circumference of the Earth as 39 690 km. Calculate the percentage deviation between your measurement and that by Eratosthenes.

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Extension: Calculate the Earth's radius (r), since you now know its circumference (C), according to the equation $C=2\pi r$.

Radius (r) =.....