

Homework Assignment #2

Due 15 September.

Aristarchus of Samos recognized that (a) light travels in straight lines and (b) the Moon is a spherical object which “shines” by reflected sunlight (**Pythagoras**). He also knew that the Earth was a spherical object (**Aristotle**) - although he didn’t know its size. He then used some very simple observations as a basis for determining the distances and sizes for the Moon and Sun, all expressed in units of the Earth’s (unknown) diameter.

His “observational data” consisted of the following:

- The angle between the Moon and the Sun on the sky when the moon is exactly half-full (first or third quarter) is measured to be 87° (**89.8°**) See the note below.*
- The angular diameters of the Sun and the Moon are the same; both are equal to 2° (**0.5°**)
- The diameter of the Earth’s shadow at the distance of the Moon (as observed during lunar eclipses) is two Moon diameters, or 4° (**1.35°**) in angular extent.

(The numbers given in parentheses are more nearly correct values.)

Using Aristarchus’ numbers, repeat his derivation of the distances to the Sun and Moon and their diameters. Your four answers should be expressed in units of the Earth’s diameter.

Repeat the above calculations using the “more correct” values given in parentheses above.

Compare the two sets of answers: What was the principal cause of Aristarchus’ rather erroneous results? (Note that the first measured angle was “off” by only 3% or so, the second by about 150%, and the third by about 26%.)

You can probably find this worked out on the web somewhere (just Google “Aristarchus”). Feel to go looking. (I did find significant mistakes in one web offering, though.) My main objective is to have you “work through” the problem to see how it was done. I want to see that work.

* Aristarchus probably didn’t measure the 87° angle directly. I think he derived it from his observation that the time between a first quarter and the following third quarter moon was about 7% longer than the time between the third quarter moon and the following first quarter Moon.