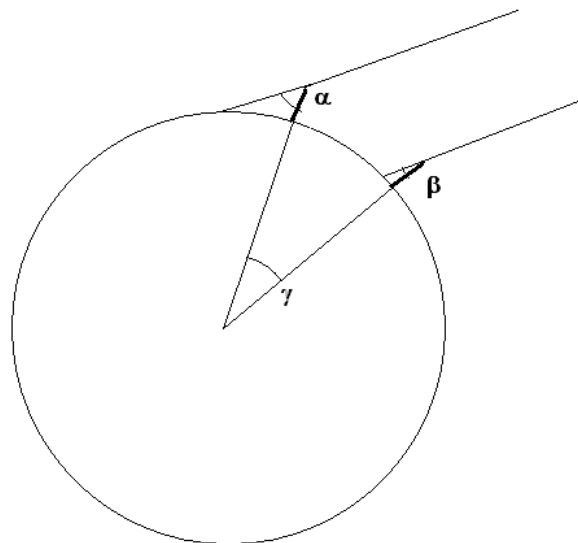




Eratosthenes by couples

In order to repeat the Eratosthenes experiment we really need two observations. One in our city (as Eratosthenes did it in Alexandria) and the other one can be a “virtual observer” in the tropic line with the Sun over his head on June 21st (as Syene for Eratosthenes).

There are other possibilities: for instance two observers in the same meridian. They will put a stick perpendicular to the soil and have to take the shadow in the same moment, at the noon. In this case the process is a little bit more difficult because we need to know the distance “*d*” on the meridian between the two observers (it can be found by Google or it can be used a good map) and the angles determined by the length of the stick and its shadow in each city.



We calculate both angles α and β by means of the measure the length of the shadow and the length of the stick.

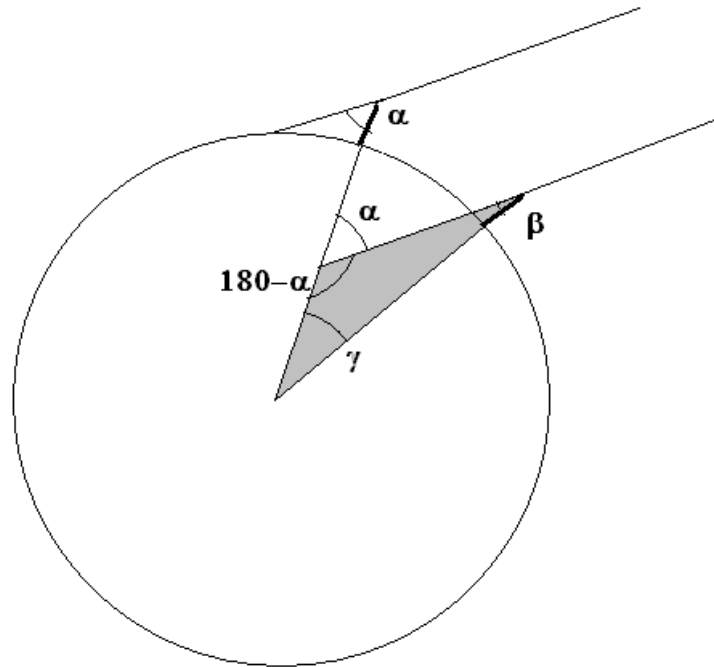
$$\alpha = \arctan (\text{shadow length})/(\text{stick length})$$

$$\beta = \arctan (\text{shadow length})/(\text{stick length})$$





In the central triangle in grey, the total addition of the three angles $180-\alpha$, plus β and plus γ must be 180 degrees. And we can calculate the central angle γ .



$$\cancel{180} = \cancel{180} - \alpha + \beta + \gamma$$

$$\gamma = \alpha - \beta$$

Finally, the central angle γ is equal to the difference of place latitudes $\alpha-\beta$. By a simple proportion, the perimeter of the earth P obtained for the couple of observers is,

$$P = d \times 360 / \gamma$$

Of course it can be considered a set of more than 2 observers in the same meridian and it is possible to prepare a statistics study of their solution when they take more measurements.

