

# Solar Day and Sidereal Day for Mercury and Venus

**Objective:** To determine the time interval of a solar day for a person living on Mercury and a person living on Venus. See *Double Play: What's so odd about a sunset on Mercury?* at <http://astro.isi.edu/notes/mercury.html> for an interesting extension of this activity.

## Mercury

In this exercise, you will calculate the solar day for a person on Mercury. The period of revolution, the time interval for Mercury to orbit the Sun (relative to the stars), for Mercury is 88 days (and when I say “day” as a unit, I am referring to Earth days). Mercury’s period of rotation, the time interval to rotate once about its axis (relative to the stars), is 59 days—this is  $\frac{2}{3}$  of the orbital period of Mercury.

What is the definition of *solar day*?

What is the definition of *sidereal day*?

A picture of Mercury’s orbit is shown below. Assume that it is circular orbit, and Mercury’s axis is not tilted. A person standing on Mercury at its equator is represented by the arrow. The dotted lines divide the orbit into thirds. From this view, Mercury is revolving counterclockwise and is rotating counterclockwise.

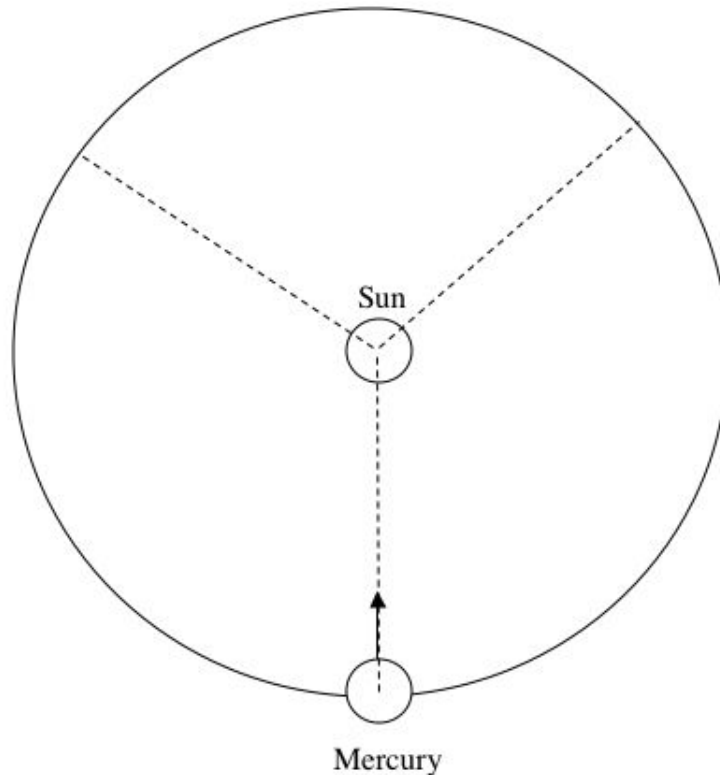


Figure 1:

At the location shown, what time is it for the person on Mercury?

After one complete rotation of Mercury, so that the arrow has the same orientation with respect to the stars, where is Mercury? Sketch the planet with the arrow in the correct orientation on the picture and label how many Earth days have passed.

What direction is the person facing when Mercury has only traveled one-third of an orbit? Sketch it on the picture as well and label how many Earth-days have passed.

Where will the planet be when it is again noon for the person on Mercury (when the arrow points directly toward the Sun)?

How many Earth days have passed since it was last noon?

How many times does Mercury orbit the Sun in one solar day (Mercurian day)?

## Venus

The rotational period of Venus is 243 Earth days. Its orbital period (period of revolution) is 225 Earth days. Venus rotates “backwards” compared to the other planets (though Uranus and Pluto orbit on their sides, meaning that their axis of rotation is nearly in the ecliptic plane). By “backwards” we mean that if from a certain view, Venus orbits counterclockwise with respect to the Sun, then it rotates clockwise.

What is approximately a solar day on Venus? Use the same technique you use for Mercury above. Start by sketching it and then determining where it is after a sidereal day, etc.