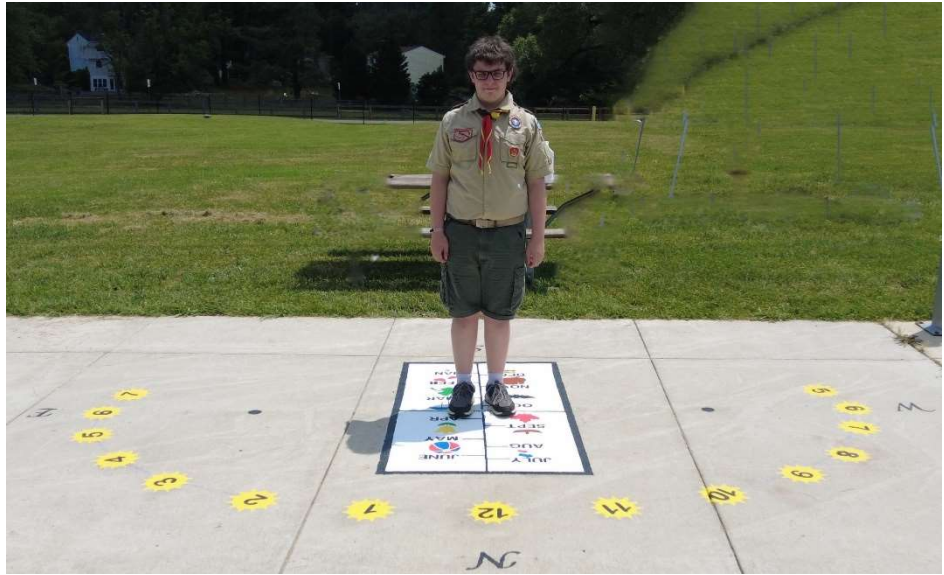


Observatory Park Analemmatic (Human) Sundial

The 12-foot Analemmatic (or Human) Sundial at Observatory Park just east of the Roll-Top Observatory was designed by Kenny Dieffenderfer as part of an Eagle Scout project. In June 2021 he enlisted Scout Troop 1547 to paint his design on the sidewalk, carefully aligning the Zodiac Walkway and 12-noon mark to true north.



This type of sundial was first described in Paris by M. De Vaulezard in 1640. Unlike other sundials that we might see in parks or gardens, this sundial uses a vertical shadow caster (gnomon). The gnomon could be a pole, but here at Observatory Park, a human is the gnomon.

An advantage of this human sundial is that it does not depend on the height of the human. Thus small children, students, parents... anyone can be the shadow casting gnomon. Telling time with this dial depends only on the shadow's angle (technically this is an azimuthal shadow casting sundial).

The dial has hour marks from 5am to 7pm carefully arranged on an ellipse specifically designed for the Observatory's latitude of 39° . ($38^\circ 59.733' N$ to be exact). 12-noon is pointing exactly north, so when the human shadow points to this time mark, the sun is telling **local solar noon**. In general, this is 9 minutes after the sun marked noon above the Eastern Time Zone meridian at 75° longitude, $2\frac{1}{4}^\circ$ east of Observatory Park (our longitude is $77^\circ 18.803' W$ to be exact). At 4 minutes of time per degree, always add 9 minutes to your shadow time.

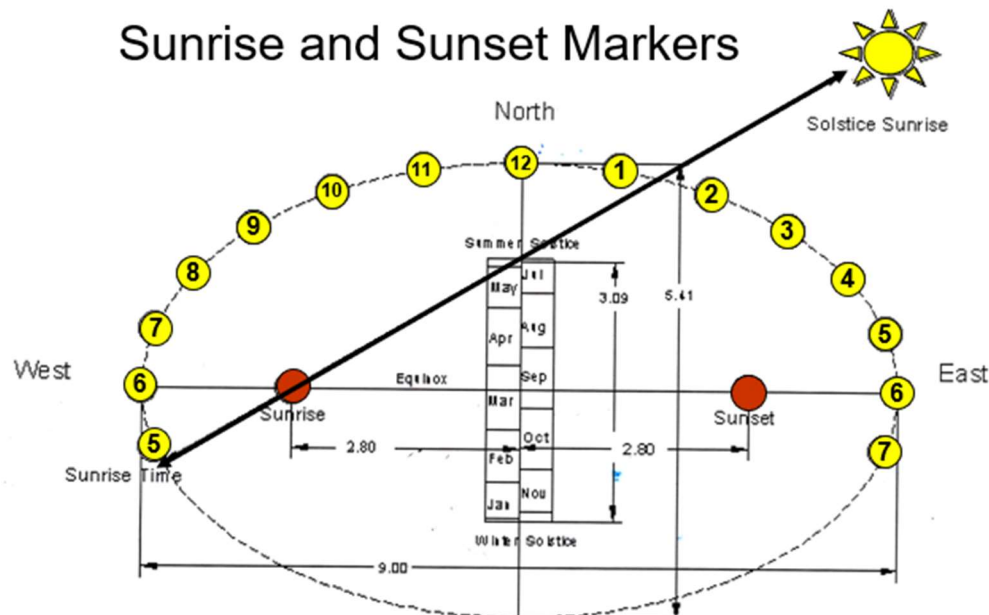
Even so, your shadow may not tell correct clock time. The sun is a poor time keeper and its noon-to-noon transit can vary plus or minus 16 minutes throughout the year. This is caused by two effects: (1) the earth's orbit is not circular around the sun, thus traveling at different speeds in its elliptical path and (2) the earth's spin axis is tilted 23.4° from being perpendicular to its orbit path.

To use a vertical (human) gnomon, the Analemmatic Sundial requires the gnomon to stand at different places throughout the year. Hence in the middle of the sundial is the Zodiac Walkway. Well, no signs of the Zodiac. Instead, there are decorated blocks showing the months of the year.

Now this is important. **DON'T STAND IN THE BLOCK.** Instead, the human gnomon must straddle the center N-S line of the Zodiac. Hence one foot is on the month of today's date (example: right foot on March) and one foot is on the opposite side of the center line (left foot on September). Notice that June/July are squeezed in the north of the walkway and December/January are squeezed in the south. The month lines are closely related to the sun's N-S travel (the position of the sun north or south from the celestial equator is called the sun's *declination*).

The Zodiac reflects the movement of the sun from winter solstice (Dec 21) to summer solstice (June 21). If you look closely at the 6am to 6pm imaginary line, it cuts the Zodiac Walkway in half at March 21 and Sep 21, the spring and fall equinoxes.

There are two other marks to the left (west) and right (east) of the walkway. These are seasonal marks to tell you the direction and time of sunrise and sunset. These marks were discovered rather recently in 2003 by Roger Bailey of the North American Sundial Society. Here, one picture is worth 1000 words:



Rather than stand on the Zodiac Walkway, walk over the sunrise marker (west side on 6am-6pm equinox line). Look across the Zodiac Walkway at (today's) month date (here we've chosen June 21 at the summer solstice). That's the direction of sunrise. Turn around 180° and you're facing the time of sunrise.

For sunset, use the eastern seasonal spot (sometimes called the Bailey Point). Look across the Zodiac Walkway at the month to see the direction of sunset. Turn around 180° and you're facing the time of sunset. Note: The seasonal markers are NOT the foci of the ellipse.

During a lunar eclipse the moon is very nearly 180° opposite the sun. You can use the Analemmatic (Human) Sundial to tell the time by moonlight! Straddle the walkway center line using the month that is 6 months ahead of the eclipse date. If the lunar eclipse were in August, straddle center line at February to cast your shadow. The time, of course, is night time (example 12-noon now becomes 12 am).

Just by carefully painting hour marks, seasonal markers and the Zodiac Walkway, Kenny and his Scout Troop made a precise scientific instrument for observing solar time in the day, using moonlight to cast shadow time at night, and find the directions and time of sunrise and sunset.