The Analemmatic Sundial

What is this thing called time really? Time is a very complex concept! Today, we are going to explore the concept of time using the Analemmatic Sundial. The analemma is this skinny figure 8 and is related to the sun's path across the sky. We will have more to say on the analemma shortly.

But let's pretend that we have no cellphones, no computers, no watches or clocks, no modern timekeeping devices of any kind. How then would we tell the time? Well, first, we would probably divide time in daytime for being awake, working, eating etc. when the sun is in the sky and it is light. Then, we would assign nighttime for sleeping and resting when the sun is not in the sky and it is dark. We would simply divide the day into 12 hours and the night into 12 hours. That would easy, except that the day is longer in the summer and short in the winter while nights are shorter in the summer and longer in the winter. That unbalanced, unequal hours concept is exactly how many agrarian cultures lived for centuries. It really didn't matter how long the day was as long as you used it effectively!

But society changes and becomes more complex and urban. If the king grants you a audience at 10 o'clock, how do you know when 10 o'clock is? Are you even on the same time as the king is keeping? In a more complex society, we had to have a standard system of hours and timekeeping. The Babylonians 2500 BCE were the first people to create standard, equal hours with 24 hours in a day, 60 minutes in an hour and even 60 seconds in a minute. They invented shadow clocks with longer and shorter shadows indicating the hours of the day. Later, it was the Egyptians who came up with the concept of the sundial with the earliest example being dated at 1500 BCE.

As society continued to progress and people started traveling, time had to be even more accurately kept. So today, time is further complicated by the use of daylight savings time and standard time zones, and time is so accurately kept that seconds are based on the vibration of a particular atom - the cesium atom. We have moved on from our astronomical based sundial!

Nevertheless, the Sundial was the first human invention that does not just keep time, it "**finds**" time. It is so accurate that right up to the 1840s, the Sundial was used for the time finding standard for hour candles, hourglasses, water clocks, and even for mechanical watches and clocks and for church bells calling the hours of services. The parts of the Sundial are very simple: a stick called the gnome and a dial showing hour lines.

As opposed to a normal sundial, an Analemmatic Sundial simply corrects for the motion of the Earth as it travels in an ellipse, not a circle, around the Sun speeding up and slowing down over the course of the year. A regular sundial at any location will run up to 16 min fast in the spring and 15 min slow in the fall because the Earth' rotation speeds up in the spring and slows down in the fall. The Analemmatic Sundial standardizes the Solar mean time at any Earth location so that high noon, as the point of highest sun elevation, is really noon!

Still another correction must also be made for the standard time zone longitude. Here, in the Pacific Time Zone, this longitude is at 120 degrees West, so close to Vernon at 119.31 degrees

West that this correction is insignificant (2 minutes 4 seconds fast) here at the Allan Brooks Nature Centre. In Victoria BC, longitude 123.36 degrees West, the Standard Time Zone correction runs 13 min slow all year. From mid-March to mid November, Pacific Standard Time converts to Pacific Daylight Savings Time, a hour advance. Thus, we will have to correct for this human made time advance!

So, after of this complex time description, **what are the steps that you must use to find the exact time using the Analemmatic Sundial?**

1. First, step onto the platform with the gnomon stick.
2. Center the gnomon stick at the correct month and day of the month by putting it into and sliding it along the north - south platform groove.
3. Note the position of the shadow of the stick on the clock numbers and estimate the time as accurately as you can. (Also note that the length of this shadow would vary according to the angle of the sun at the various seasons.)
4. If we are now on Pacific Daylight Savings Time, add one hour to the time from the Sundial that you have noted to adjust from Pacific Standard Time.
5. Again, look at the month and approximate day perpendicular to you on the platform. Then, note the minutes of correction on the platform's analemma shape directly across horizontally from where the gnomon stick is planted. (The maximum is 15 minutes slow or fast and the minimum is zero.)
6. These minutes have already been subtracted or added these minutes of correction from your estimated Sundial time because of your use of the Analemmatic Sundial rather than a regular sundial. By moving the gnomon stick to the correct date rather than leaving it at the centre, you did the correction!
7. You should now have a "**found**" time from the Sundial which should match your call phone or watch time.

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"How did it get so late so soon?" - Dr. Seuss
"Time is an illusion." - Einstein

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