Angle of elevation of the Sun (it is not a lesson but an experience)

Find a shadow. To do that you may carefully use the light sound device ( higher tones means no shadow, lower tones mean inside the shade) check how the tones vary and find exactly where the shade starts and ends in height and width. Using a tactile ruler/meter/yard or a knotted cord or any material you have contextualized to gather measurements, measure the length of the shadow (the distance from where it begins to where it finishes, if you are walking do it carefully). If you are using a knotted cord the knots have to be precisely spaced. For now lets scan/walk/touch from the object casting the shadow, along the shadow, right to the point where it ends away from the object. Annotate the length. Now stand at that point, do not remove the whatever you are using to measure (i.e tactile broomstick, meter or knotted line). What do you notice regarding the position of the measurement tool you are using and the object casting the shadow? The place where both unite (the floor side of the object and the shadow) makes a shape resembling like a letter L. At that point where the two sides of the letter L join, both sides make a right angle of 90 degrees respect to each other…Now. The length of the shadow is a line that extends from the chair/your toes to the point where the shadow begins at the object. When doing it inside that length is the shade will extend from the point of the shade most far away from the object to the top of the object. Now imagine a line extends diagonally from your chair ( if you are sitting) or toes , to the top of the object that is casting the shadow lets say it is a lamp-post, the line touches the top of the object casting the shadow and continues until it touches the sun or the top of the object ... if you are outside ( not need to be outside and protect your skin and do not ever turn your eyes towards the sun) or the top of the object you are using. So you have the line made by the shade, the line made by the object casting the shade and the line uniting the point at the edge of the shade fartest away from the shade to the top of the object casting it….try it? You may make a model with straws to check the shape it makes…it is a triangle!

Trigonometry teaches us that the tangent of an angle is calculated with the measurement of the length of the side opposite to the angle.......divided by the length of the side next to the angle. In our case it will be the length of the line making the height of the object casting the shadow divided by the length of the shadow ...the two sides of the letter L (from the object to the point of the shadow farther away from it). Then the tangent is result of a division where you divide the length of the opposite side to the angle ( the real height of the object casting the shadow) divided by the length of the shadow..... In my case I use a folding cane divided in 6 segments. As I know how long my cane is ( 6feet) I use it to approximate the height of the object either if i am indoors or outdoors as i know the size of each segment. The inverse of that calculated tangent is called the arctangent. That arctangent will give you the angle of elevation of the Sun. how do we do that? Get the two numbers, divide them and then insert the result in your talking calculator, regular calculator or using the mobile calculator or the internet find a free online one, find the arctan button and press it. We challenge you to try it! ( make sure your calculator is set for degrees). We are including at the end of this experience the link to an arcTan calculator that we accessed from Italy ( Because I was living there at that time). We are aware that it may not be displayed in other countries and not everyone has access to internet, perhaps using the native calculator of your telephone with the native screen reader of your telephone may be a solution or asking for a sighted person with a calculator to help you. A search online may take you to find a calculator you may calculate both the tangent and the arc tangent . https:// www.rapidtables.com/calc/math/Arctan\_Calculator.html . Congratulations you have calculated the angle of elevation of the sun.

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Going Beyond: Sun rise on the east? Learning from <https://pwg.gsfc.nasa.gov/stargaze/Ssky.htm> may we challenge you to identify sensorially when the sun is closest to the horizon? We learnt that when the Sun is near the horizon, not only are the shadows which it casts stretched to greater length, its illumination too. Any beam of sunlight spreads out along a greater distance on the ground. What happens then if a beam of light is not so focused over a great area? Then it weakens, like when stretching something, then the heat over any area is less. That is why even though it is the same sun all year round, the noontime Sun in winter is low in the sky, but its heating is less pronounced, while the summer Sun can be almost overhead, heating the ground much more effectively.

And going more beyond: using the concept of shadows, and length of time the sun crosses from sun-rise to sun set. Find a year of sunrise and sunset times online. Plot it as time vis day. You will notice that the time the sun is on the sky changes being shorter during the winter and longer during the summer.

For farmers , working people like street vendors to understand and identify those concepts of brightness, shadow, brightness is very important to plan a work day.