



CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

Name(s) Vasilios A. Morikis	Project Number J1528
Project Title Measurement of True Noon Time Using the Sundial Principle	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project aims to prove the hypothesis that the true noon (or solar noon) in Riverside during the end of January-beginning of February does not occur at 12:00 Pacific Standard Time. This hypothesis is based on the observation that the sun is directly above us at a different time during the seasons. True noon is defined when the sun is directly above our location.</p> <p>Methods/Materials The physical principle is similar to that of the sun dial. A ruler was positioned vertically on a table covered by graph paper. The position of the shadow of the ruler on the graph paper was monitored between 10:30 AM and 3:00 PM at approximately 10-15 minute intervals. Once the measurements were finished I traced the lines of the shadow of the ruler on the graph paper and I measured their length. The data showed the behavior of a parabola formed by the ends of the lines. The shortest line coincided with the minimum of the parabola. This minimum corresponded to the true noon time. I performed five experimental trials at two different locations. I plotted the data using a spreadsheet. To determine the minimum I fitted the data using the function of a parabola. The fitting aimed to reduce the measurement errors and help locate the minimum of the parabola in a more precise way.</p> <p>Results The data showed that true noon at the end of January-beginning of February in Riverside is at 12:11 PM. This result is in agreement with my hypothesis that true noon does not coincide with the noon of standard time this time of the year. At true noon the angle made by the sun rays and the ruler (angle of incidence) is also minimum, resulting to shortest shadow length. The angle of incidence is a measure of the sun elevation. I measured the angle of incidence at true noon after drawing on the graph paper the right triangle with perpendicular sides corresponding to the length of the ruler and the ruler shadow. I discuss the effect of refraction of the sun rays on the measurement of the angle of incidence.</p> <p>Conclusions/Discussion True noon depends on the sun elevation. The sun elevation depends on the geographic latitude of our location and the time of the year. My results are in good agreement with values determined from the analemma drawn on a globe and the Riverside sun dial outside the Riverside public library. I have used principles from physics, geometry, and statistical fitting to make the astronomical measurement of true noon time.</p>	
Summary Statement My data and my readings about the analemma showed that true noon time is variable throughout the year and depends on geographic location.	
Help Received Dad and mom helped me understand the concept of statistical fitting.	