Sun Inclinometer

Curriculum
Levels 3-4
Maths

Activity Description

Students will transform a protractor into an accurate and reliable instrument that measures the angle of the sun and by taking multiple measurements they will be able to determine its apparent path through the sky during a day at or near Solstice, Equinox (or any other time of the year).

Teaching rationale

Students will:

- Develop multiple skills across a wide range of the Level 3-4 Mathematics Curriculum including angle measurement, data collection, graphing and interpretation.

Note: This activity could easily be used at Level 5-6 of the Science Curriculum referencing the Planet Earth & Beyond topic of Astronomical Systems.

Curriculum Links

MATHEMATICS	Level 3 - 4 Achievement Objectives	Specific Learning Outcomes
Geometry & Measurement	**Measurement** Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. **Position and orientation** Use a co-ordinate system or the language of direction and distance to specify locations and describe paths.	1. Measure angles on a protractor using an inclinometer. 2. Apply the simple equation that the sun angle is found by subtracting the angle reading on the protractor from 90 degrees. 3. Gather angle measurement data in a table to create a simple whole number time-series. 4. Graph the angle of the sun as it varies through time of day. 5. Identify the time series as showing the path of the sun pattern. 6. Describe the apparent path of the sun through the sky at a certain time of year. 7. Communicate that the sun path changes depending on the season and time of year and/or location.
Statistics	**Statistical investigation** Gathering ... whole-number data and simple time-series data to answer questions. Identifying patterns and trends in context. Communicating findings, using data displays.	
Number & Algebra	**Equations and expressions** Record and interpret additive and simple multiplicative strategies, using, words, diagrams, and symbols, with an understanding of equality. **Patterns and relationships** Connect members of sequential patterns with their ordinal position and use **tables**, **graphs**, and **diagrams** to **find relationships** between successive elements of number and **spatial patterns**.	

Useful support material

- Visit the school solar section of schoolgen.co.nz and check out the solar graphs.

Running the activity

- Use the ‘How to make a sun inclinometer’ video and steps on schoolgen.co.nz to make these with your class
- Print out the student worksheets

Extending your students

- Check the other School-gen make projects on schoolgen.co.nz

Student worksheet

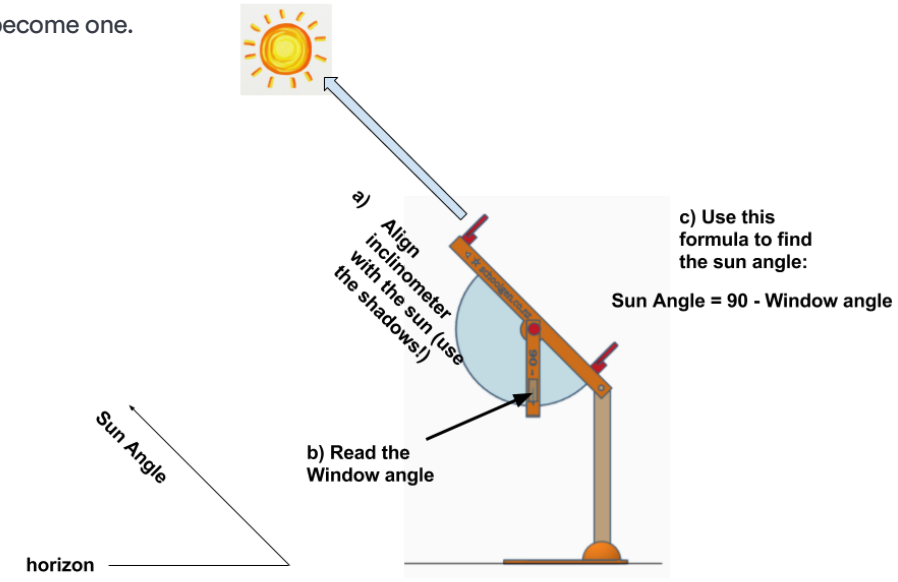
Sun Inclinometer - The Path of the Sun at Solstice or Equinox

In this activity, you will learn

- How to find the angle of the sun above the horizon at different times of the day
- How the sun appears differently over winter, spring, summer and autumn
- About the Solstice or Equinox when the earth is in a particular position in its orbit around the sun.

Instructions

1. If you haven't been supplied with a Sun Inclinometer then use the How to make a sun inclinometer steps from the School-gen website. Check out the sun inclinometer video to see tips on how to make it and how to use it.
2. Note the following instructions on how to measure the angle of the sun
3. Find a flat surface outside in the sun. Look at where the shadow of your sun sights are.
4. Rotate your sun inclinometer until it's pointing in the direction of the sun.
5. Tilt your sun inclinometer until the two shadows cast by the sun sights become one.
6. Read the angle of the protractor in the window of your hang bar to the nearest degree.
7. Subtract this angle from 90 degrees to find the angle of the sun above the horizon.
8. Measure and record the sun angles at different times through the day (can be a few days apart) and make a graph to show the sun's path through the sky. Use the diagram below to guide you and record your results in the table below.



1. Results Table

Date/s: .....

Circle: Nearest to **Summer Solstice, Autumn Equinox, Winter Solstice, Spring Equinox** ?

Time you measured the sun angle?	Window Angle	Sun Angle

2. Draw and graph of your results

Graph the results on an angle vs time of day graph. Carefully draw a smooth curved line through the points. This represents the apparent path of the sun through the sky! Hint- You could also do this in Google Sheets and get it to draw a graph.

3. Use your graph to help answer the following questions.

(a) What time of day (to the nearest quarter hour) is the sun highest (largest angle above the horizon) in the sky?

(b) What is the maximum angle of the sun at this time?

(c) Extend the curve on your graph to estimate the time of sunrise and sunset?

(d) Estimate the length of the day in hours?

(e) Will the days get longer or shorter from now on?