

How to make a sun inclinometer

1. Before you start

- ✦ Use a 3D printer and this template to print off the 3D printed bits.
- ✦ To find out more about [3D printing](#) see our [3D tips and tricks](#) at school-gen.co.nz.



2. What you'll need

- ✦ 3D printed sun sights x2
- ✦ 3D printed axis bolts x2
- ✦ 3D printed angle beam
- ✦ 3D printed hang bar (we call this an angle measurer too)
- ✦ 3D printed base
- ✦ Protractor
- ✦ Ice-cream stick
- ✦ Nut and bolt (3mm diameter and 12mm long)
- ✦ A small weight
- ✦ Blu-tack or PVA glue
- ✦ Hand drill and screwdriver
- ✦ Pen or highlighter



3. Get started

Step 1:

Insert your sun sights into your angle beam by slotting the flat end of the sun sights into the holes in the angle beam.

Step 2:

Now place the flat side of your protractor into the slot underneath your angle beam. Make sure the numbers on your protractor are on the School-gen side of the angle beam.

Did you know an **linclinometer** or **Clinometer** is a device for measuring the angle of inclination of something, especially from the horizontal

Step 3:

Take your hang bar and slide it over the middle of your protractor so the holes at the end are over the holes in your angle beam. Make sure the side that says '-90' is on the School-gen side of the angle beam.

Step 4:

Secure your hang bar to the angle beam by inserting your axis bolts on either side of the hang bar into the holes on the angle beam. Check your hang bar swings freely.

Did you know that at Winter Solstice, the sun's angle is the lowest in the sky for the whole year.

Step 6:

Put your ice cream stick in the 3D printed base (make sure you put the non-drilled end in). Use a bit of Blu-tack to hold this in place.

Did you know solar panels get the most energy when they are pointed right at the sun.

Step 8:

Using some more Blu-tack fit your weight to the end of your hanging bar. Make sure it's fitting nice and snug. Now you have a sun inclinometer it's time to get measuring.

Step 5:

Now you need to drill a small hole in your ice cream stick so the bolt can go through it. Mark where to drill by sliding your ice cream stick into your angle beam, and drawing through the hole in the angle beam onto your ice cream stick with a pen.

Step 7:

Now insert the drilled end of ice cream stick into your angle beam, making sure you line up all the holes. Keep them held together by putting the bolt through the angle beam, into the ice cream stick and out the other side. Put the nut on the end of the bolt and tighten it.

**4.
Finding the
angle of
the sun**

- ✘ Find a flat surface outside in the sun. Look at where the shadow of your sun sights are.
- ✘ Rotate your sun inclinometer until it's pointing in the direction of the sun.
- ✘ Tilt your sun inclinometer until the two shadows cast by the sun sights become one.
- ✘ Read the angle of the protractor in the window of your hang bar to the nearest degree.
- ✘ Subtract this angle from 90 degrees to find the angle of the sun above the horizon.

Did you know You can tell the time and the season from the angle of the sun above the horizon, and map its direction.



5. Finding the angle of a roof

- ✦ Find a suitable roof to measure. You'll need to be looking at it from side on so that the top and bottom of the room are the same distance away from you.
- ✦ Holding your sun inclinometer from the side, adjust the hanging bar so it's parallel with the slope of the roof.
- ✦ Read the angle of the protractor in the window of your hang bar to the nearest degree.
- ✦ Subtract this angle from 90 degrees to find the angle of the sun above the horizon.

Did you know that the best angle for fixed solar panels in NZ is 30 degrees and facing somewhere between north-east and north-west.



6. Finished? What's next

Visit Schoolgen.co.nz to check out other projects you can do.

We've also pulled together some cool challenges to get you thinking and innovating! The easiest ones are at the top of each list, the harder ones at the end are for budding scientists and engineers.

More minds are better than one so get a team together and start throwing some ideas around and come up with a plan of attack.

- ✦ Record the sun angles at Equinox, Solstice or Matariki at different times through the day (you can do this over a few days) and make a graph to show the sun's path through the sky.
- ✦ Find the seasons when the sun's position in the sky changes. When is it fastest? When is it slowest?
- ✦ Research why True North is sometimes called Solar North and how it is different from Magnetic North.
- ✦ Find the angle of the roof at your house or school - which would be best for solar panels? Write a report to your Principal outlining the pros and cons of installing solar.
- ✦ Make a sun-clock or sundial based on measurements from the sun inclinometer.

