

Sun, Shadows & Triangles

How can you find the sun angle from a shadow?

Part 1- Measuring my shadow

1. Write down the date and time of day:

Date: _____ Time: _____

2. Measure your height with a tape measure:

My actual height is _____ cm

3. Go outside in the sun if it is sunny and find some flat concrete.

4. Look at your shadow on some flat ground

(is it longer or shorter than you are?)

My shadow is _____ than I am.

5. Put your arms straight out from your sides and turn around until your **shadow-arms** are widest. You are now facing directly away from the sun.

6. Get your partner to put a chalk mark on the concrete right between your two feet, and another mark at the top of your shadow head.

7. Use a tape measure to measure the distance between the two marks.

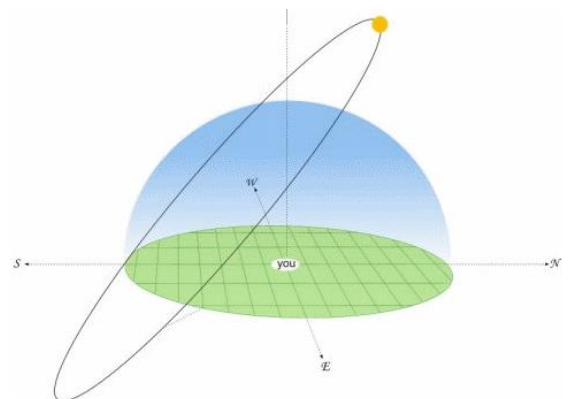
My shadow height is _____ cm

8. Use a calculator to divide your actual height by your shadow height

*Shadow height \div actual height = _____ (this number is called a **ratio**)*

Use the chart below to find the closest angle to the number you just wrote (circle the angle now).

Ratio	Sun angle ($^{\circ}$)
2.7	20 $^{\circ}$
1.7	30 $^{\circ}$
1.4	35 $^{\circ}$
1.2	40 $^{\circ}$
1.0	45 $^{\circ}$
0.8	50 $^{\circ}$
0.7	55 $^{\circ}$
0.6	60 $^{\circ}$
0.5	65 $^{\circ}$
0.4	70 $^{\circ}$
0.3	75 $^{\circ}$
0.2	80 $^{\circ}$

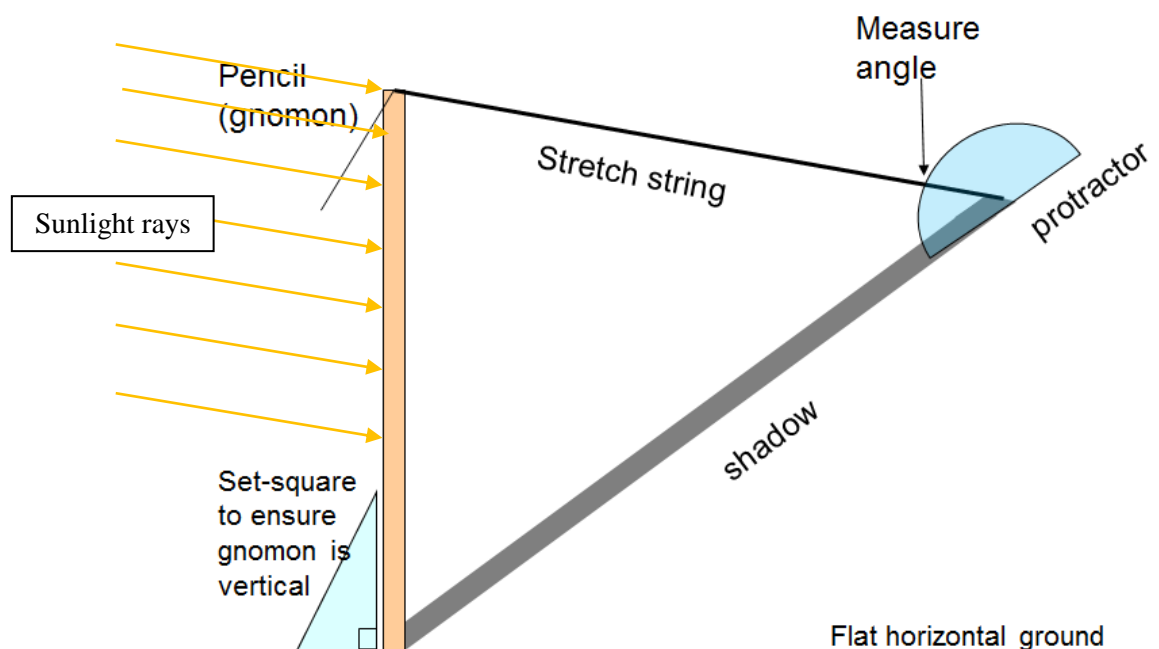


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Part 2- Measuring the angle of the sun's rays

1. The diagram below shows how to do this part of the investigation.
2. Use your Schoolgen pencil as a gnomon – make sure it is sticking up at 90 degrees from the flat ground.
3. Stretch a piece of string from the tip of the gnomon to the tip of the shadow.
4. One person uses a protractor to measure the angle of the string – this will also be the angle of the sun in the sky (since light moves in a straight line).

The angle of the sun in the sky right now is: _____ degrees.



Other things to look for-

- Can you see the tip of the shadow moving?
- Is the tip of the shadow getting longer or shorter?

Questions

1. What happens to your shadow as the sun gets higher?
2. What happens to your shadow as the sun gets lower?
3. At what time of the **day** is the sun angle highest? _____
4. What direction is the sun at this time of day? _____
5. What direction does a shadow point when the sun is highest? _____
6. At what time of **year** is the sun angle highest? _____
7. At what time of **year** is the sun angle lowest? _____
8. Whereabouts in New Zealand would the sun be highest in summer? _____
9. Does the sun ever get straight over head (90°) in NZ? _____
10. *Extra for experts-* In Auckland in **summer** the highest sun angle is about 77° above the horizon.
What would be the best angle for a PV panel on a north facing roof in Summer?