

## STARDOME OBSERVATORY & PLANETARIUM FACTS, RESOURCES AND ACTIVITIES ON...

# TWO-SIDED SUNDIALS

This resource explores measuring time and the cyclic movement of the Sun during the year.

Imagine standing at the Equator. The Sun at midday will be directly overhead in March and September, when the day and the night are the same length (the equinoxes). Because of the tilt and rotation of Earth, in mid-December the noon Sun is 23° south and in mid-June it is 23° north (the solstices) of the zenith. (Check out the link to the Seasons and Ecliptic Simulator.)

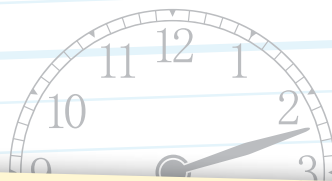
Still at the equator, if you turned a normal (horizontal) sundial 90° vertically (so it would be parallel with the Equator) and added a second faceplate and gnomon, the Sun would cast a shadow on the southern side for half the year and the northern side for the other half of the year.

If you then move that sundial away from the equator, it will work the same way if you keep the face plate parallel with the Earth's equator. This is achieved by tilting it at the same angle as your local latitude, which is about 37° for Auckland.

This is called an equatorial sundial, and it is like a model of the Earth. Imagine that the sundial plane is a slice of Earth representing the equator. The gnomon acts as the axis of Earth's rotation. In New Zealand the upper sundial face represents the southern hemisphere, and the lower dial face is the Northern hemisphere. The Sun will cast a shadow on the upper side in Summer and the lower side during Winter.

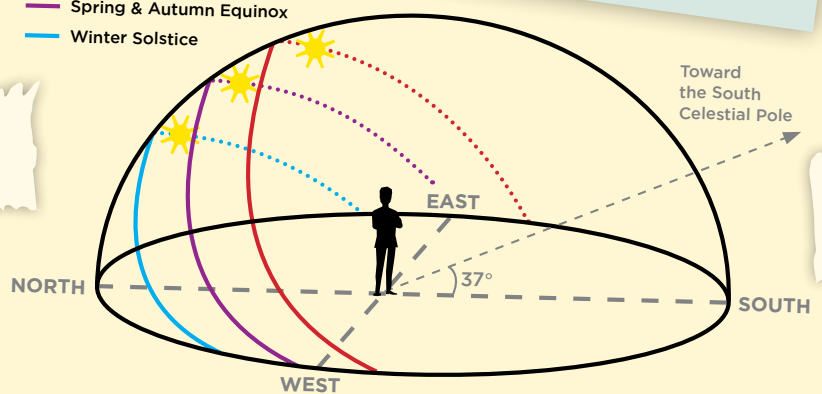
### SCIENCE CONTENT/ CURRICULUM LINK

EXTEND THEIR EXPERIENCES AND PERSONAL EXPLANATIONS OF THE NATURAL WORLD THROUGH EXPLORATION, PLAY, ASKING QUESTIONS, AND DISCUSSING SIMPLE MODELS. SEEK AND DESCRIBE SIMPLE PATTERNS IN PHYSICAL PHENOMENA. SHARING IDEAS AND OBSERVATIONS ABOUT THE SUN.



#### AUCKLAND

- Summer Solstice
- Spring & Autumn Equinox
- Winter Solstice



### DEFINITIONS

**Gnomon** - the part of the Sundial that projects the shadow

**Zenith** - the point in the sky directly above your head

**Solstice** - most northern and southern limit of Sun's movement in the sky (June and December)

**Equinox** - When day and night are the same length (mid-March and mid-September)

### Check out these other resources...

➔ **Parts of a sundial:** [www.mysundial.ca/tsp/sundials\\_dialling.html](http://www.mysundial.ca/tsp/sundials_dialling.html)

➔ **Sundial basics:** [www.rnzih.org.nz/pages/sundial2.htm](http://www.rnzih.org.nz/pages/sundial2.htm)

➔ **Another way to make an equatorial sundial:** [www.skyandtelescope.com/observing/how-to-make-a-sundial](http://www.skyandtelescope.com/observing/how-to-make-a-sundial)

➔ **Seasons and Ecliptic Simulator:** [astro.unl.edu/naap/motion1/animations/seasons\\_ecliptic.swf](http://astro.unl.edu/naap/motion1/animations/seasons_ecliptic.swf)

Large equatorial sundial.  
IMAGE CREDIT: WIKIPEDIA



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**09 624 1246**

# ACTIVITY

## STARDOME OBSERVATORY & PLANETARIUM

# CREATE A TWO-SIDED SUNDIAL!

This sundial shows standard time on the lower face (March to September) and daylight saving time on the upper face (September to March). The clock will show local time to within about 15 minutes.

### Resources needed:

- ⇒ Reasonably stiff light-coloured card
- ⇒ Tape or glue
- ⇒ Toothpick (or similar)
- ⇒ Scissors

### Instructions...

- This worksheet has been formatted to print on both sides so that the gnomon aligns.
- After printing both sides, cut around the template and fold back the base and sides so that the South side is facing upwards. Secure the tabs with tape or glue to the underside of the base. Ensure the folds are straight and the shape is not distorted.
- If your class wants to personalise their sundials it would be best to do this before folding and securing into the final shape. The toothpick or similar skewer used for the gnomon should be pierced through the sundial to keep it perpendicular to the faceplate.
- The completed sundial needs to rest on a flat horizontal surface in full Sun. It also needs to face north/south. To find the direction of true north (magnetic north from a compass will indicate erroneous times), you can 'cheat' using the sundial. Place your sundial in the sunlight at a convenient hour (this works best between 9am-3pm rather than near sunrise/set). Using your watch or phone, align the dial so the shadow is cast on the correct time. This aligns your dial facing north. Mark this direction with chalk or a pen on the surface you will be using, so you can place the dial in the correct spot each time.
- The hour lines on this sundial are offset to account for New Zealand's location. NZ is not 180° from Greenwich, so local midday does not occur exactly 12 hours ahead of Greenwich Mean Time. There is about 20 minutes of 'daylight saving' built into NZ Standard Time.

What is the difference between an equatorial sundial and a regular sundial?

Does a sundial work at the South Pole?

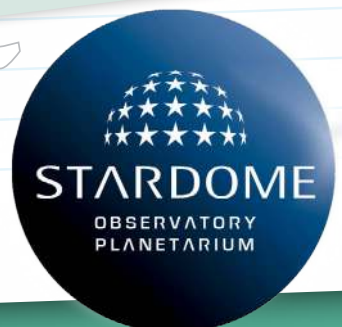
DISCUSSION POINTS

Why is the sundial adjusted for Auckland's location?

Make the sundial early in the year (before March) and repeat the activity observing the Sun at midday in mid-March, June, September and at the end of the year.

This will reveal the seasonal motion of the Sun during the year.

Take a photo of your sundial activity and send it to us. We'd love to see it!  
[education@stardome.org.nz](mailto:education@stardome.org.nz)

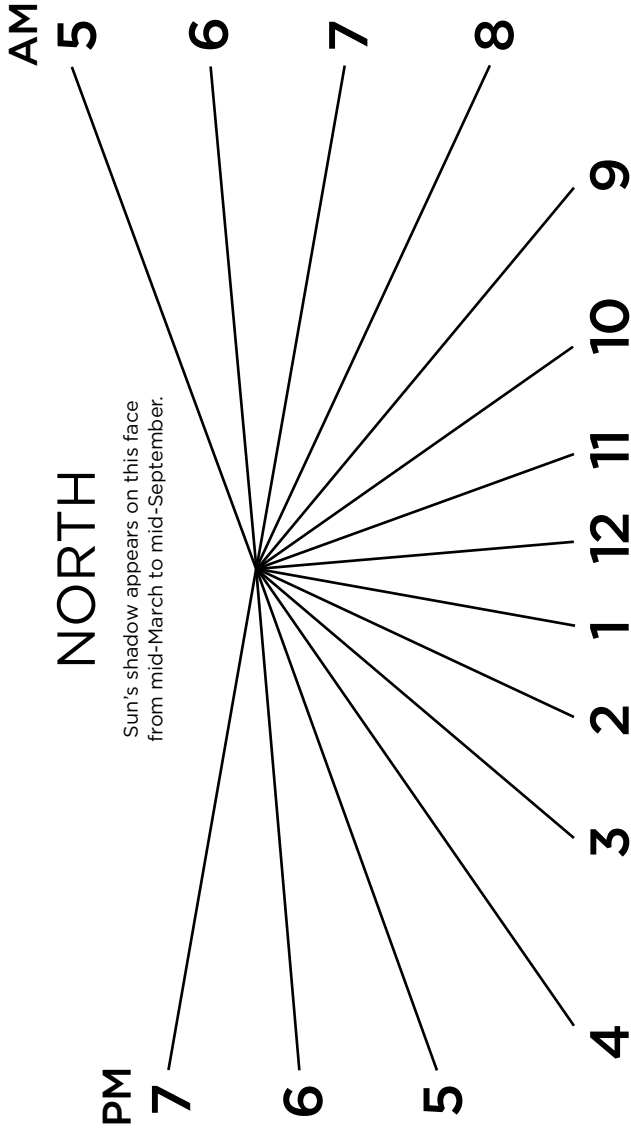


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# TWO-SIDED SUNDIAL

NORTH

Sun's shadow appears on this face from mid-March to mid-September.



Hour lines have been adjusted to show New Zealand Standard Time.

For use in New Zealand at latitudes near 37° South. Most accurate in the Auckland region.



North



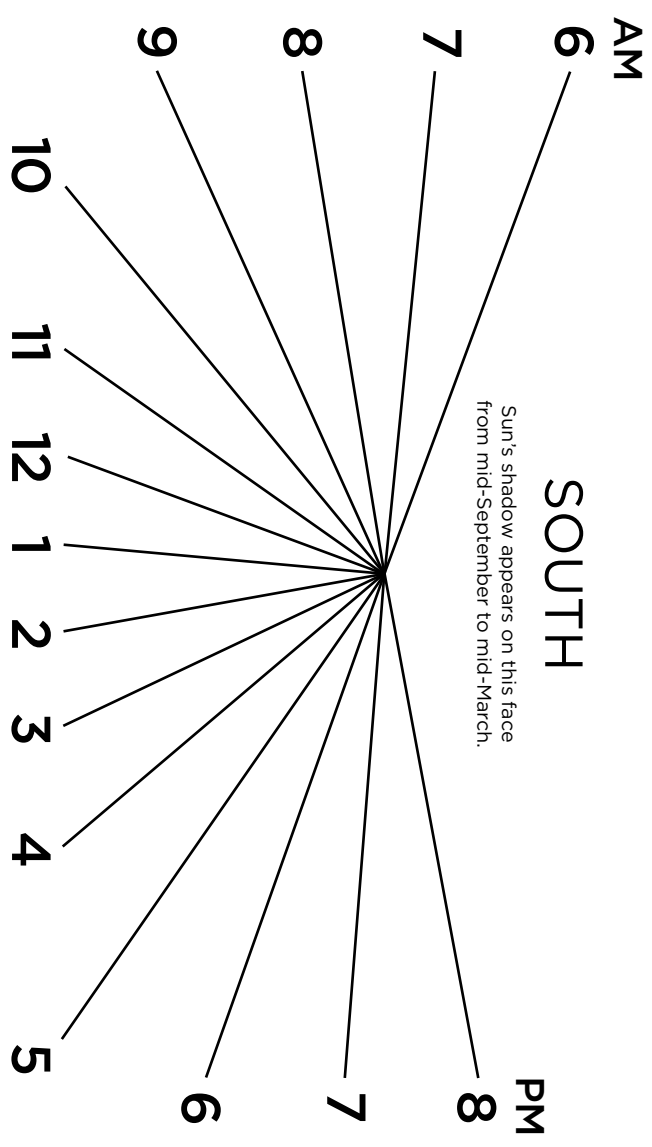
North



# TWO-SIDED SUNDIAL

SOUTH

Sun's shadow appears on this face from mid-September to mid-March.



Hour lines have been adjusted to show New Zealand Daylight Saving Time.

Name: \_\_\_\_\_

