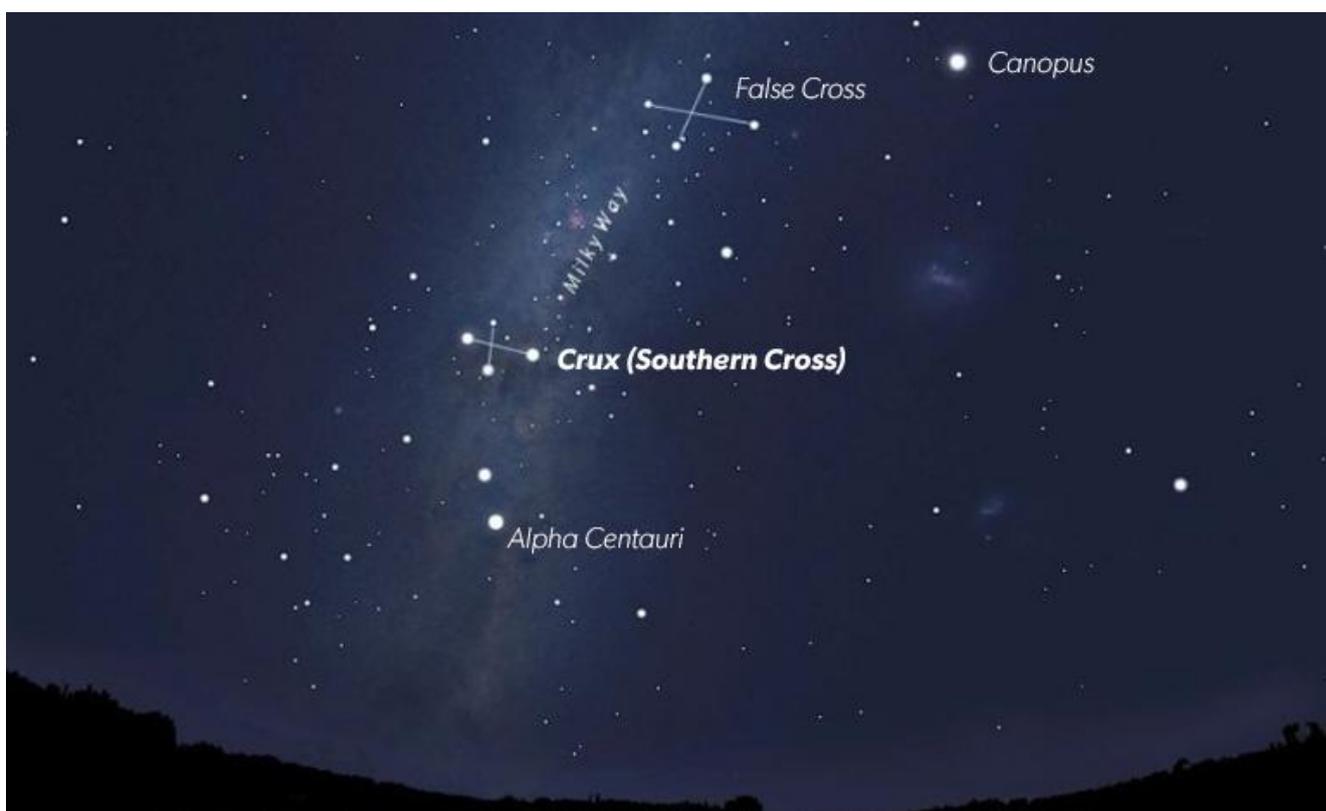


Navigation – Stars – Celestial Navigation

Polynesian navigators used stars to locate land. Navigators could place their Waka (canoe) immediately beneath a star at its highest point in the sky in the knowledge that this would point them to an island.

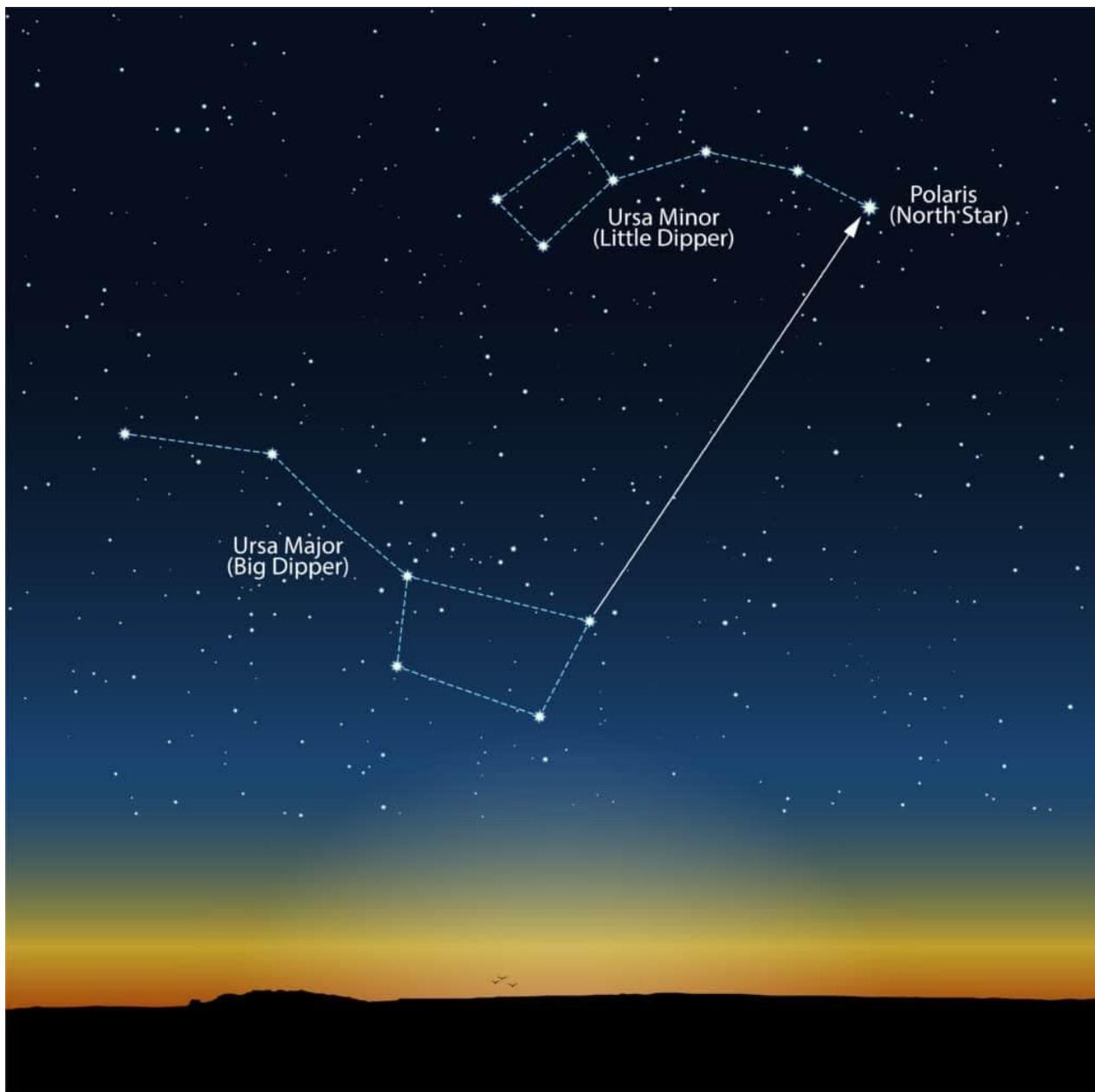
The navigators knew the position of the stars in relation to the time of the year. They knew how to use the stars to find south, north east and west.

The Southern Cross in the Southern Hemisphere shows due South



NAVIGATION – Pupil Worksheet – Stars

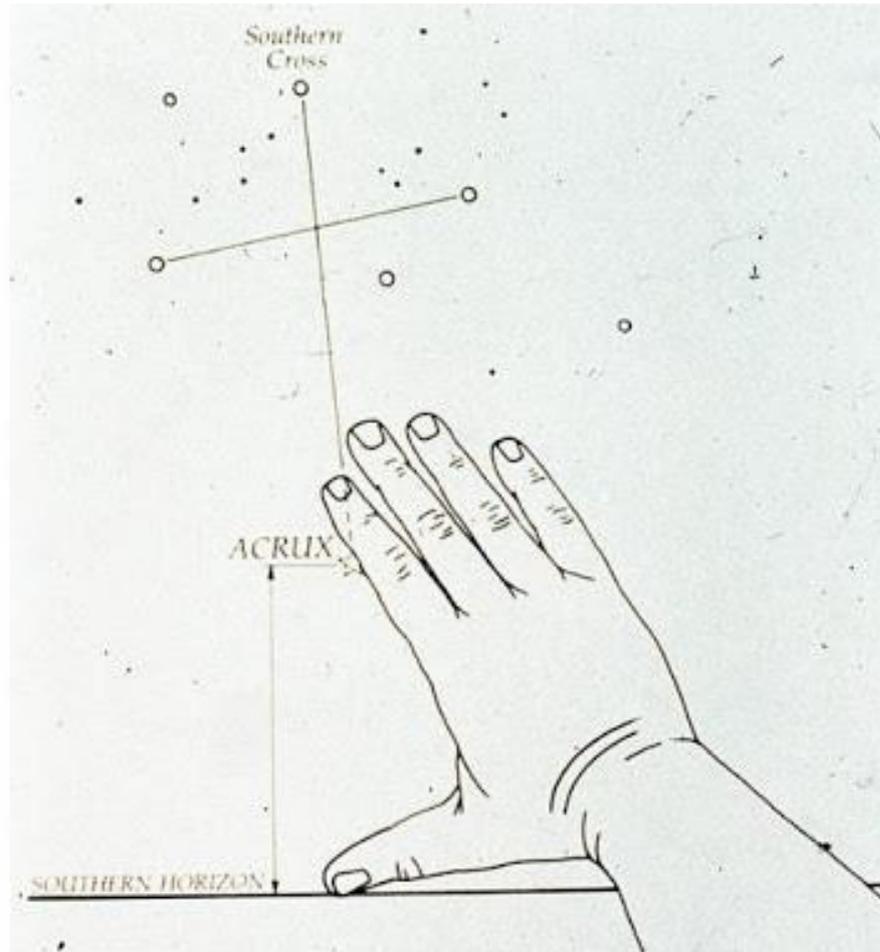
The North Star in the Northern Hemisphere shows due North – on a dark clear night see if you can find it. The Big and Little Dipper point to it.



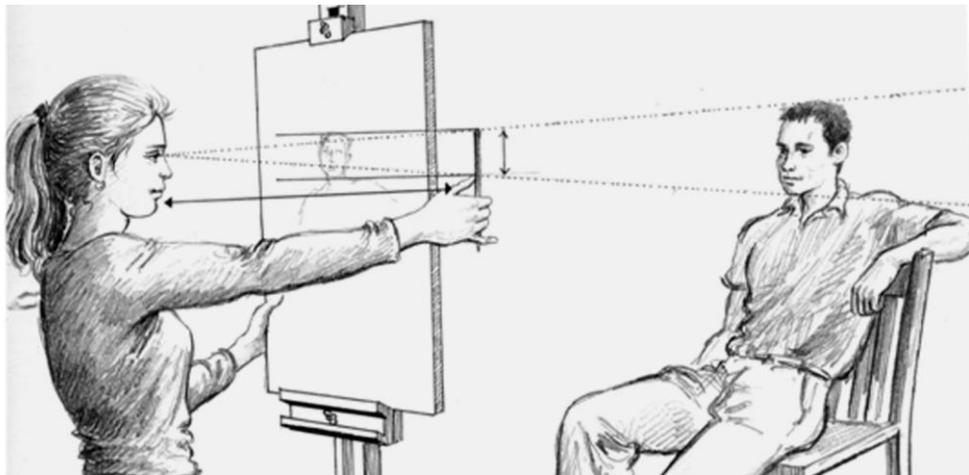
Sailing Waka had points marked around their hull to line up with the stars so that a certain star can be followed by lining it up with the mark.

Polynesian navigators measured the height of stars, moon and sun above the horizon to find their position. Fingers and hands held at arm's length can be used for measuring height above the horizon.

NAVIGATION – Pupil Worksheet – Stars



Try measuring something in the distance using your fingers at arm's length



A pencil and a straight arm is all you need to take measurements for a drawing. Your head must remain in the same place and if you bend your arm the measurements will not be consistent.

See how accurately you can draw by only drawing what you can measure. Keep it simple.

NAVIGATION – Pupil Worksheet – Stars

Doing your drawing this way you are plotting points from the world on your paper.

Look at the angle the top and bottom of the head make going into the girl's eye.
Would this angle get bigger or smaller if the girl moved further away?

Answer.

This principle is used for navigation.

The points you plot for the drawing are measurements of angles from your eye. If you reverse the process the angles can be used to plot your position in the world.

From your ship what would you measure the angle of in the day time?

Answer.

From your ship what would you measure the angle of at night time?

Answer.

What would always be at the same angle from your ship?

Answer

NAVIGATION – Pupil Worksheet – Stars

The Polynesians measured the angle between the horizon and the stars and planets.

When you are in a ship in an ocean the horizon is always visible so the angles of stars or planets above the horizon can be measured.



- Standing in Hawaii the bottom of the Southern Cross is four fingers widths above the horizon
- Standing at the Equator the bottom of the Southern Cross is one full hand span above the horizon
- Standing further south in Tahiti the bottom of the Southern Cross is two hand spans above the horizon

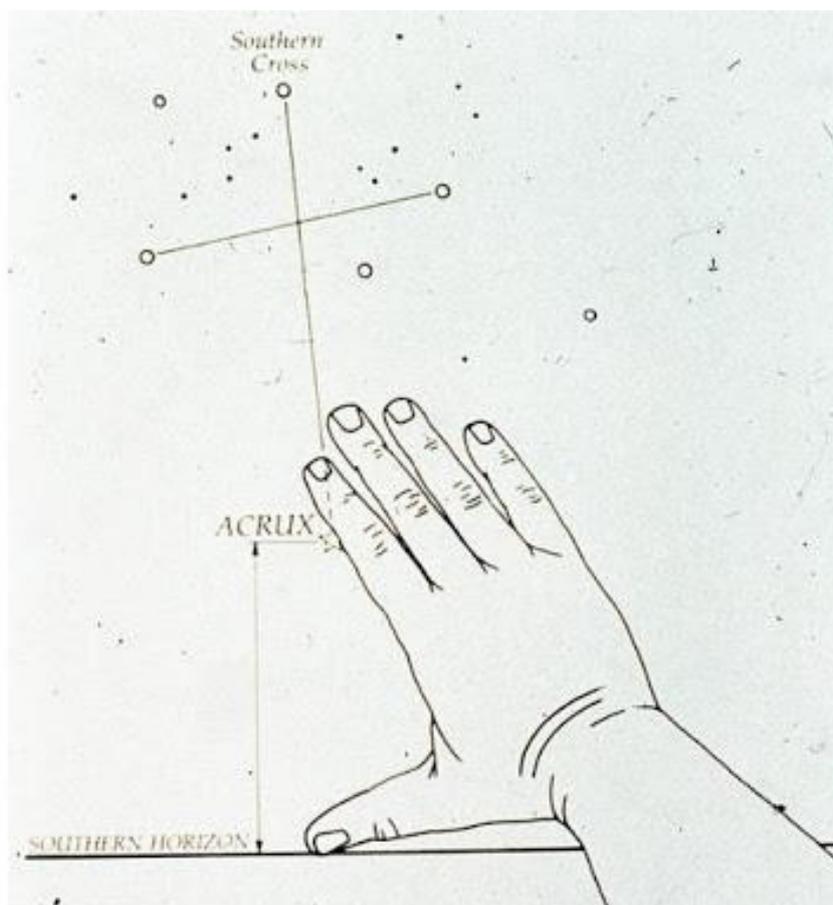


NAVIGATION – Pupil Worksheet – Stars

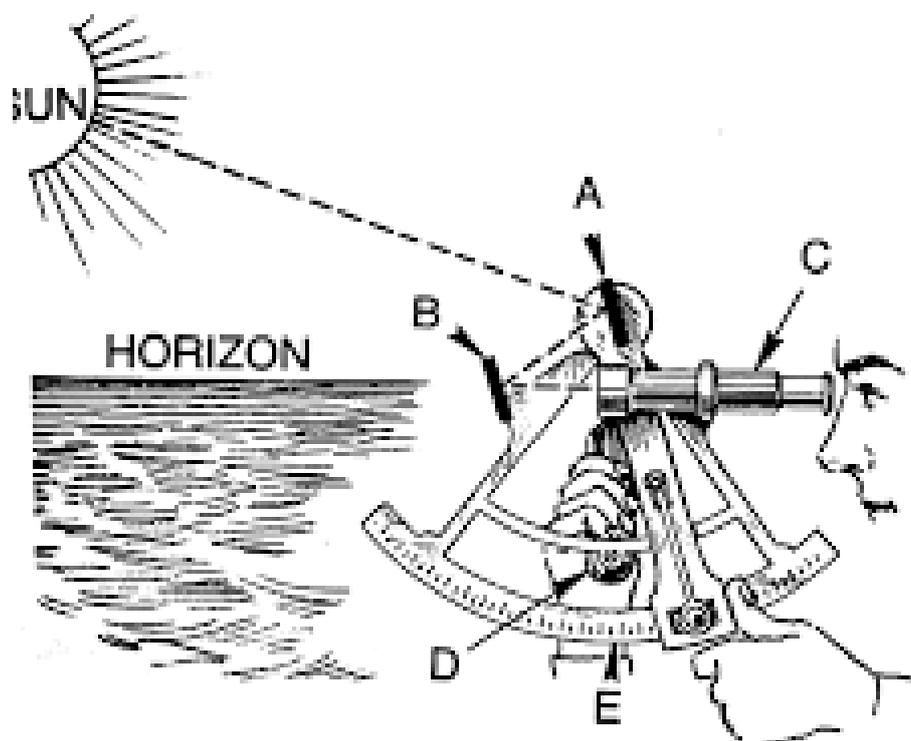
Where do you think this hand measuring the height from the Southern Horizon to the star at the base of the Southern Cross is in the Pacific Ocea .

ot your answer on the map and explain how you worked it put.

Answer.



Make your own Sextant – A device used for measuring angles above the horizon.



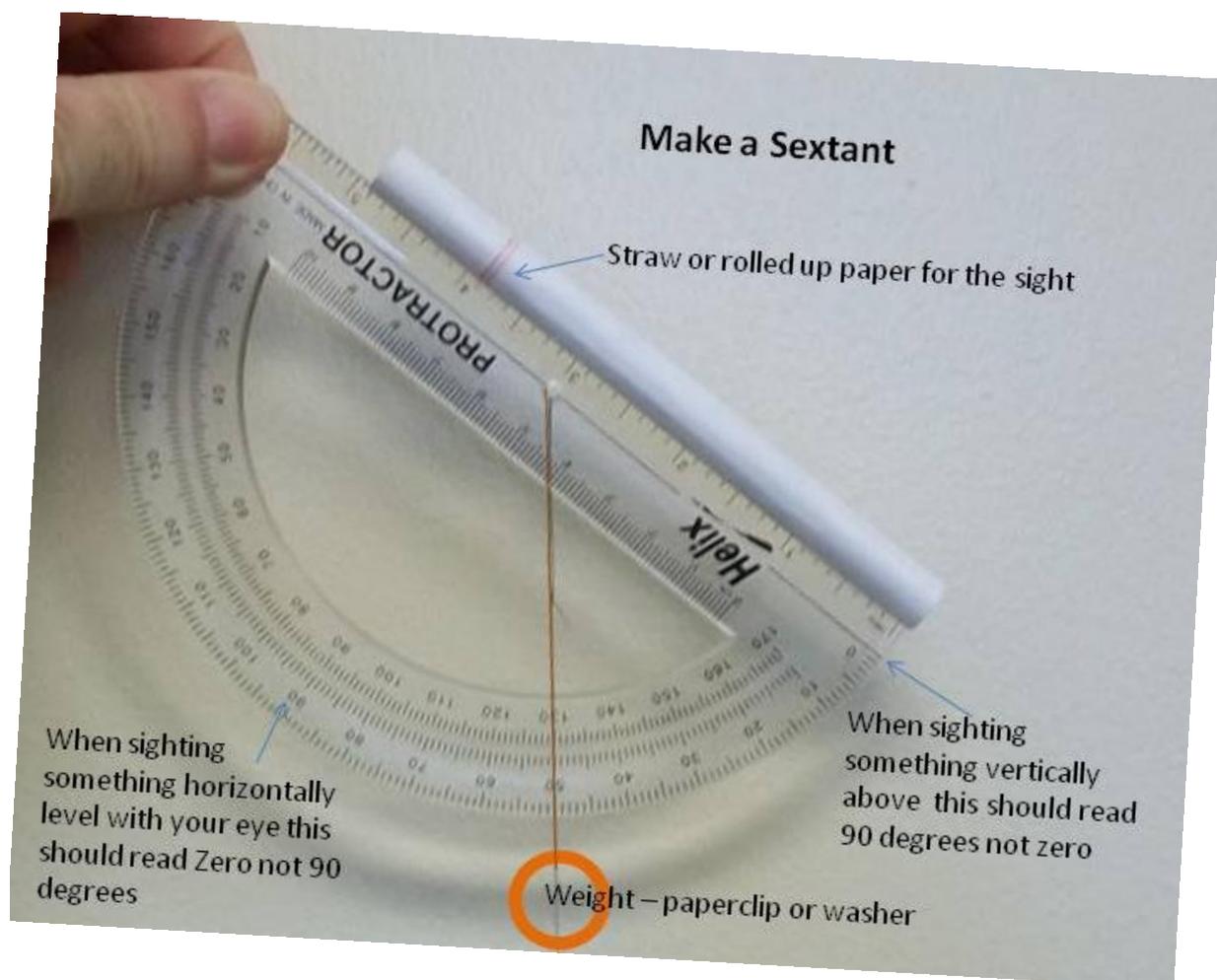
Work in pairs

You need -

- A paper straw or rolled up paper to make the sight
- A protractor to measure the angle
- A paperclip or washer, swinging as a weight to find vertical
- Tape to hold the straw along the straight edge of the protractor
- A partner to read the angle when you are sighting the object

On a standard protractor you will need to mark the angles up differently. You will need to

- Zero degrees to be horizontal. The protractor will have this as 90 degrees change it to zero
- 90 degrees to be vertical. the protractor will have this as Zero degrees change it to 90 degrees
- Mark up every 10 degrees on the protractor from Zero to 90



The string tells us that this sextant or protractor is being held at 40 degrees from the horizontal. (Remember to switch the markings or it will read 50 degrees like the one in this picture!)

Measure the angle to the top of a tree (or another high object) from various distances. If you are right under the tree looking straight up the tree's trunk what will the sextant read?

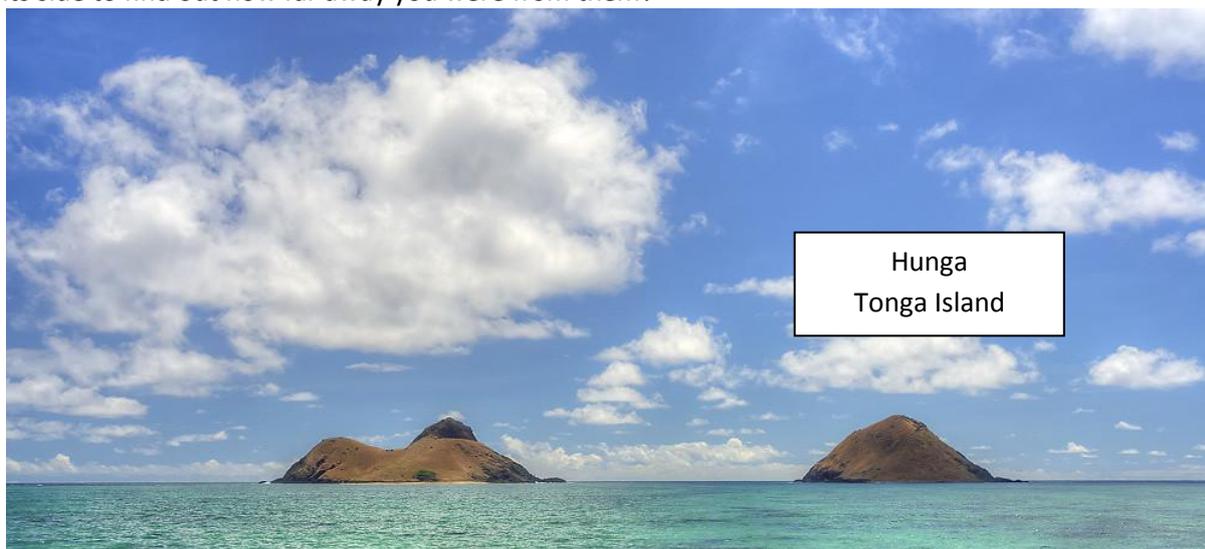
Answer.

Suppose you get an angle of 15 Degrees to the top of the tree. Plot your position on this diagram.



NAVIGATION – Pupil Worksheet – Stars

You are out in the ocean and you see two islands on the horizon. You can use your sextant device on its side to find out how far away you were from them?



You know you are heading south and measure the angle between the two mountain tops as 42 Degrees. Plot your position on the map



Your sailing waka is somewhere on this line

NAVIGATION – Pupil Worksheet – Stars

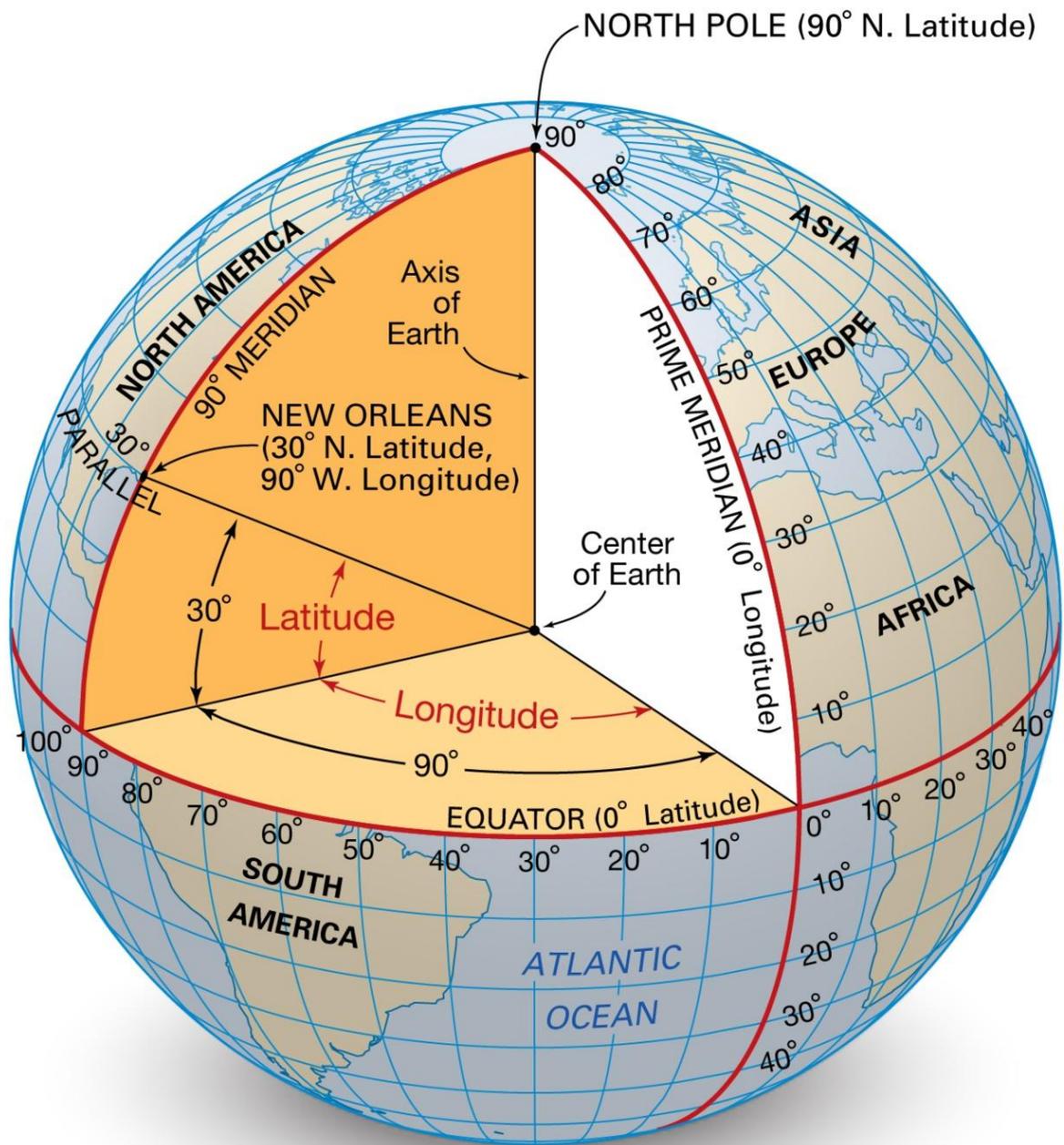
The angles of between the stars and the horizon are the important angles for a navigator. As they show how far North or South you are.

This diagram shows navigation lines around the Earth called lines of latitude.

The lines are parallel to the Equator which runs around the middle of the earth.

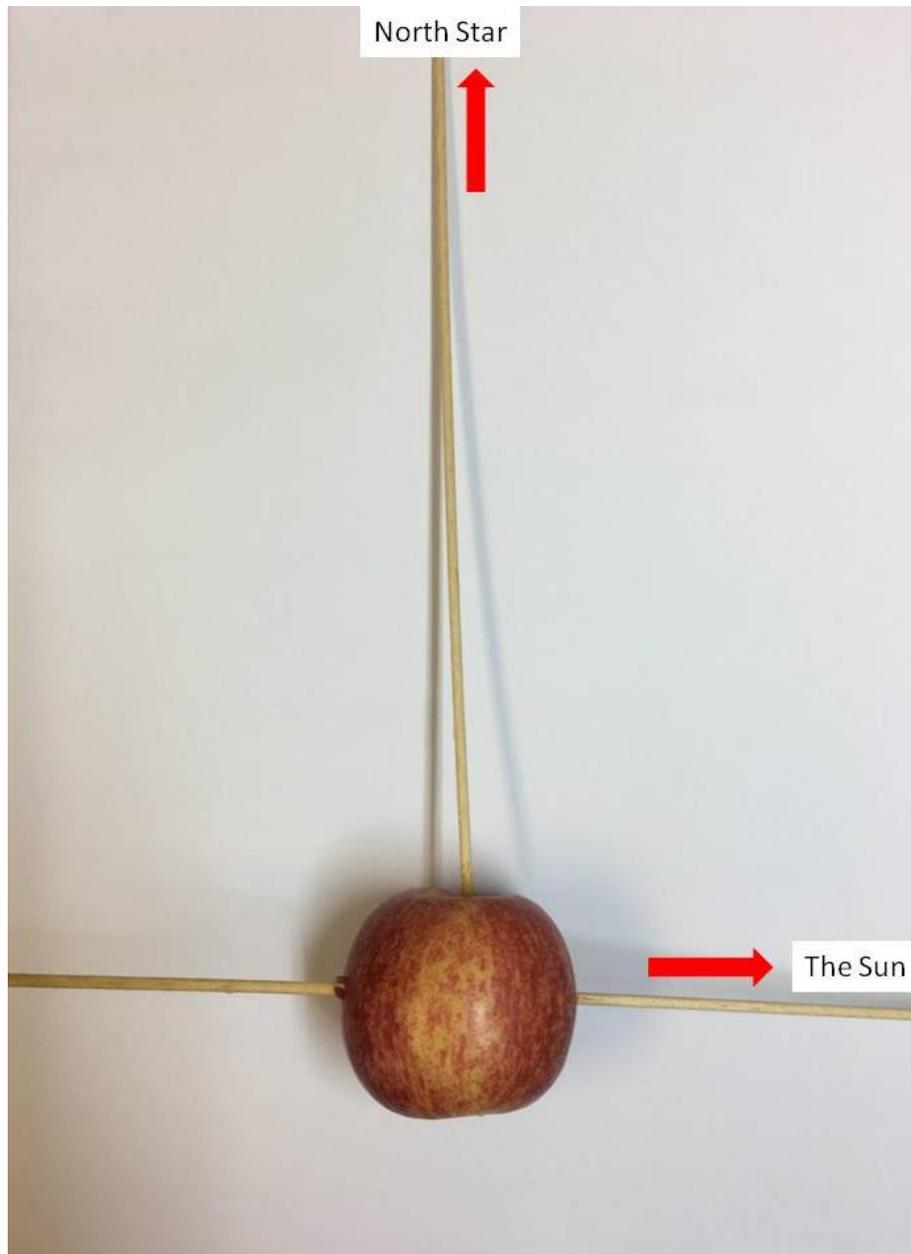
Lines of latitude are marked in degrees north or south of the Equator.

Measuring the angles of the stars and sun above the horizon means you can locate how many degrees north or south of the equator you are.



NAVIGATION – Pupil Worksheet – Stars

Set up a model using long skewers and an apple or orange to show the earth in relation to the North Star and the Sun. The North Star is directly above the North Pole and the Sun is directly above the Equator.

**Mark on the picture above**

➤ The North Pole	➤ The South Pole
➤ The Equator	➤ An arrow to the Southern Cross
➤ A line of Latitude in the Northern Hemisphere	➤ A line of latitude in the Southern Hemisphere

Imagine you were standing on the Equator

➤ What is the angle of the sun above the horizon?	➤ What is the angle of the North Star above the horizon?
Answer	Answer

Imagine you were standing at the North Pole

➤ What is the angle of the sun above the horizon?	➤ What is the angle of the North Star above the horizon?
Answer	Answer

Imagine you were standing on the South Pole

➤ What is the angle of the sun above the horizon?	➤ What is the angle of the Southern Cross above the horizon?
Answer	Answer

Imagine you were standing somewhere in-between the North Pole and the Equator

Explain how measuring the angle of the Sun and the North Star could help you find your latitude?

Answer.

Do you think the Polynesian and Maori navigators knew the earth was round and if so why?

Answer.

Do sailors still use a sextant and why?

Answer.

What do you use to navigate?

Answer.

NAVIGATION – Pupil Worksheet – Stars

Polynesian Maps

Waves take new shape when the prevailing swell strikes an island and bounces back on itself. Polynesian navigators can detect 'Bounce-back' waves 50 km away from small islands, and up to 300 km away from big islands like New Zealand.

Wave patterns divide and curl around an island. Polynesian Navigators can detect this confused wave before the island is in sight.

To read the currents and swells the navigators would watch the angles of trailing ropes in the water behind their Sailing Waka.

Polynesian Maps of the oceans show wind, currents, swells and the position of islands. Label the two Polynesian Island Maps with what you think each part is representing?

- Currents
- Winds
- Islands
- Positions where an island comes into view

Why didn't these Polynesians draw a map on paper?

Answer.

Use a map of your school and show how teachers and pupils move around the school at lunch time.

NAVIGATION – Pupil Worksheet – Stars

