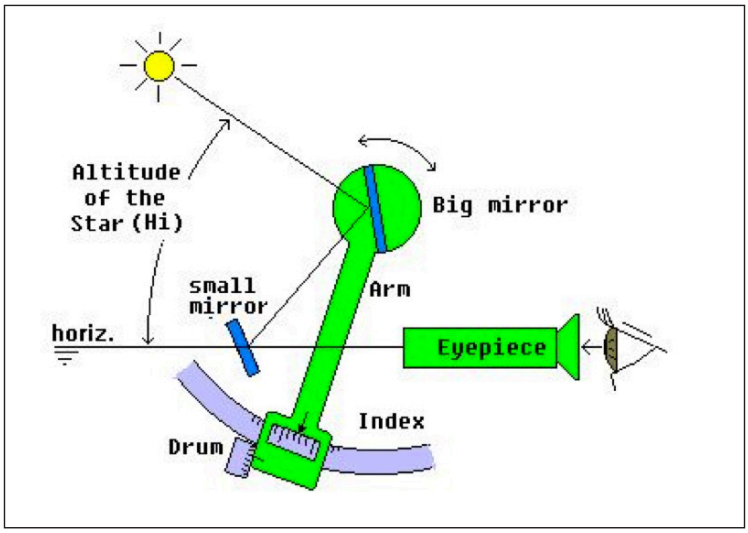
Aventura SAILING ASSOCIATION inc.
24707 Dana Drive, Dana Point, CA 92629
949-493-9493 www.AventuraSailing.com

Sailing Academy

Basic Celestial Navigation The Sextant

How a Sextant Works

Many of us have seen photographs of seamen using a marine sextant. What exactly is that navigator measuring?

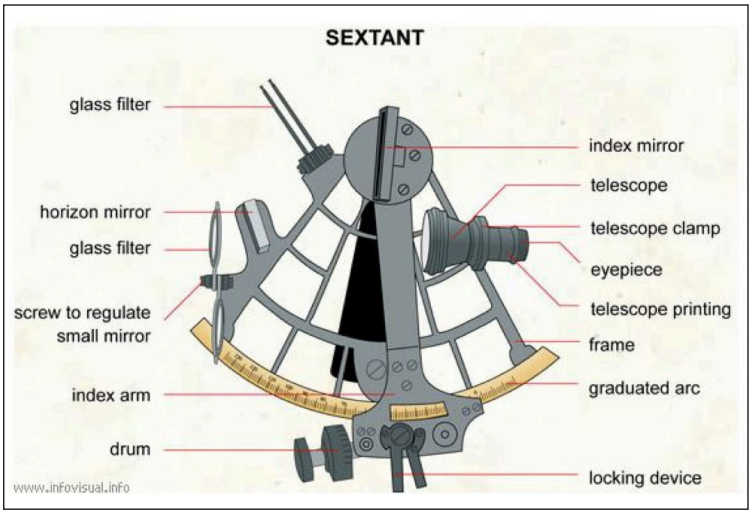


Sextant Navigation - The Altitudes

In marine navigation, when a navigator measures the altitude of a celestial body with a marine sextant he has to measure the altitude as an angle of the body above the visible horizon.

The Marine Sextant

The sextant derives its name from the extent of its limb which is the sixth part of a circle, or 60 degrees. The marine sextant is a double reflection instrument, used for measuring angles in then same plane. The arc is graduated into degrees from right to left from 0 to 120 (sometimes a little more). However the limb is only 1/6th of a circle due to the instrument double reflecting.



The Principle of the Sextant

The optical principle used in a sextant is this: given that a ray of light is reflected from two mirrors in succession, then the angle between the first and last direction of the ray is twice the angle between the mirrors.

This is the angle that is read off on the ‘arc’ after the navigator ‘shoots a star’ (takes an altitude).

How is a Sight Taken?

A navigator will decide which stars or planets to ‘shoot’, depending on time of day, clarity of the horizon and the heavenly bodies (stars and planets) that he or she can see clearly.

The taking of the altitude involves ‘bringing the celestial body down to the horizon’ when seen through the sextant. This means that the reflection of the body, as seen through the sextant, is slowly lowered down to a point when it is just touching the horizon. This is done by first setting the sextant to zero and slowly and smoothly moving the arm of the sextant, all the while keeping the reflection of the body in sight within the instrument. Finer adjustments are made with the micrometer.

When the navigator is satisfied that the body is perfectly on the horizon the angle is then read off the scale on the sextant.

Aventura SAILING ASSOCIATION inc.
24707 Dana Drive, Dana Point, CA 92629
949-493-9493 www.AventuraSailing.com

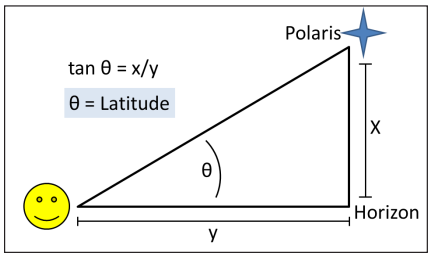
Sailing Academy

Basic Celestial Navigation Finding Latitude & Longitude

The planet is spinning, and because the planet spins, the stars in the sky appear to rotate in a circle. If you're moving, and the stars are moving, you can't use them as a guide, either you or the stars must be stable.

Finding Latitude Using Polaris - The North Star

There are two points in the sky that don't move, the Celestial Poles. These are the points in the sky that fall along the line of the earth's axis of rotation. In the Northern Hemisphere, there is a star, Polaris, that falls almost exactly at that point. In the Southern Hemisphere, there is nothing to mark the southern celestial pole. The angle between Polaris, an observer, and the horizon equals latitude.



Finding Latitude Using The Sun

Measure the angle between the horizon and the sun when the sun is at its highest point, which is right around noontime on your watch. Use the sextant to determine the altitude of the noontime sun. Use the navigation tables in the back of the guidebook to determine the declination of the sun for the date of your observation. Use the formula in the guidebook to determine your local latitude.

Finding Longitude

The planet is spinning, and because the planet spins, the stars appear to rotate above us in a great circle that takes exactly one day to complete its rotation. Lines of longitude run parallel to the axis of the Earth's rotation. This means that there is no fixed point in the sky to use as a guide. This ultimately means that longitude, despite being a coordinate in space, is practically a function of time. So to find longitude, you need to know three things:

1. The speed of the Earth's rotation: 15 degrees per Hour
2. The time the sun peaks at the prime meridian: 1200 GMT
3. The time the sun peak, in GMT, at your location.

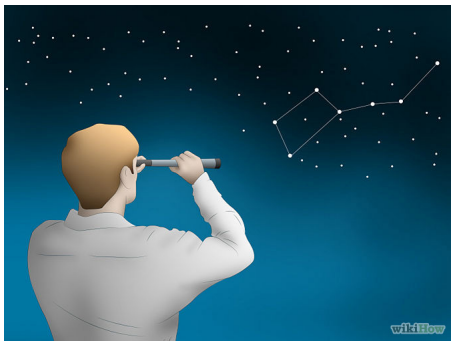
Numbers 1 and 2 are known variables, all you need to do is determine the time the sun peaks at your location. If, for example, you live on the East Coast of the United States, and the sun peaks at 1700 GMT, then all you have to do is subtract 1200 from 1700 and multiply by 15 degrees for every hour – congratulations, you're at 75 degrees West.

The more accurate the sight on the sun, and the more accurate your clock, the more accurate your reading will be. The most accurate maritime clocks were chronometers, and they changed the way we travel across the sea.

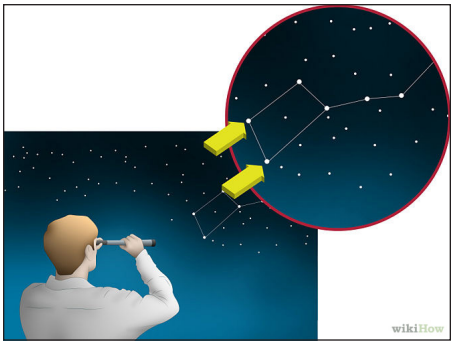
How to Find Polaris - The North Star

The North Star, also known as Polaris, is close to the point where all of the northern stars currently rotate around, the Celestial North Pole.

1. Locate the Big Dipper. This is an asterism, part of the much larger constellation Ursa Major.



2. Find the two stars on the side of the constellation farthest away from the "handle".



3. Draw a line from the fainter star (Merak) to the brighter star (Dubhe).

4. Continue the line and you will find the north star (Polaris).