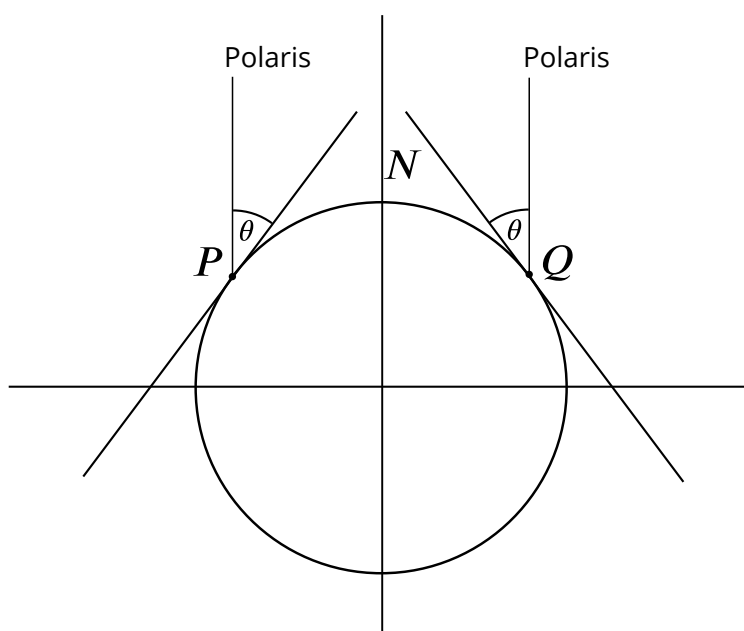


The longitude problem

In [Calculating latitude](#) we saw how a little geometry helps adventurous seafarers to work out their [latitude](#). People have been using the stars to do this for millennia. But longitude is a different story. It wasn't until the eighteenth century that people found a way to measure [longitude](#) reliably, and the fact that they couldn't do so earlier has lost countless lives at sea. The solution to the problem was eventually delivered by a clock.

Latitude can be measured using the position of the star Polaris above the horizon because that position changes as you move north or south, that is, as you vary your latitude. For longitude this isn't the case: the position of Polaris does not change as you move east or west, varying your longitude. You can see this in the two-dimensional picture below. The points P and Q lie on different meridians, but the angles arising from the position of Polaris are the same.



What does change as you move east or west is the time of day. For every 15° of longitude you move eastwards, the local time moves one hour forwards, and for every 15° you move westwards the local time moves back by an hour. Therefore, if you know your local time and the time at Greenwich, you can use the difference to work out your longitude. Finding your local time is easy even if you haven't got a clock: you simply observe the position of the Sun. The only way to know the time at Greenwich, however, is to carry a clock with you.

This seems easy today, but until not that long ago it was a huge problem. The clocks that existed were too sensitive to be taken on a ship: the rocking and rolling would make them inaccurate. Sailors' inability to determine longitude had disastrous consequences. An example is the Scilly naval disaster of 1707 in which four British ships sank just off the Isles of Scilly, tantalisingly close to their home port of Portsmouth. Because sailors could not work

out their exact position, together with bad weather, the ships struck rocks, resulting in the death of up to 2000 men and one of the worst naval disasters in British history.

Several nations, including the Dutch and the Spanish, had already offered prizes to anyone who could solve the longitude problem, and in 1714 the British followed suit, offering up to a massive (at the time) £20000. All sorts of solutions had been proposed. One involved carrying a wounded dog on board ship which, thanks to a mysterious alchemical treatment, would howl every time it was noon in Greenwich. Others were more scientific. For example, comparing the position of the Moon against the other stars and then consulting a detailed catalogue of stars makes it possible to determine the local time with a fair degree of accuracy. The method is time consuming, however, and prone to errors.

It was a working class joiner from Lincolnshire who finally won the Longitude Prize. From 1730 onwards John Harrison worked on maritime clocks, the last two of which were accurate enough to win the prize. Claiming the prize, however, was a long struggle, as the Longitude Board stubbornly refused to hand it out in full. It took an appeal to King George III and then to Parliament to set things right. "By God, Harrison, I will see you righted!" is what King George is said to have exclaimed, and Harrison finally received the remaining money, as well as the recognition he deserved, in 1773. He died three years later on his 83rd birthday.