



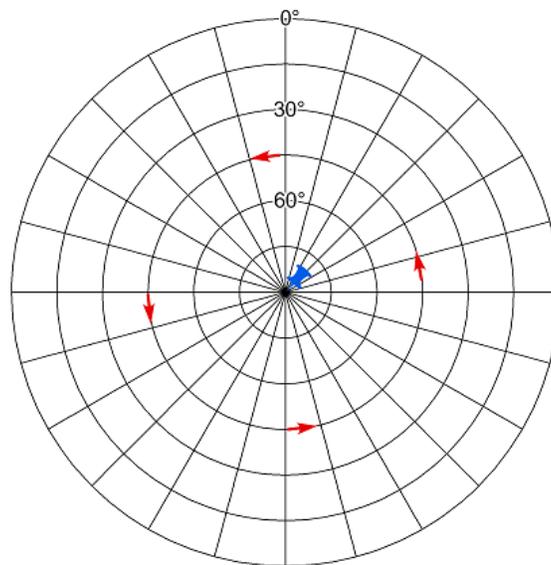
Field Notes From the Armchair Geographer

Revisiting the 69-mile Rule

The '69'-mile rule was always a good way to estimate the circumference of the Earth. Since 1 degree of a Great Circle = 69 miles (approximately), the equation for Earth circumference was simple: 69 miles x 360 (degrees in a circle) = 24,840 miles.

In my physical geography courses, I take that a step further and make students calculate their speed of rotation. If you lived in Quito, Ecuador at the equator, and have the 69 mile rule handy, its another simple math problem: total miles of Earth rotation in one day divided by 24 hours in an average day. $24,840 / 24 = 1035$ mph, which leads to a bad joke: people on the Equator sure do get around fast!

So what about us in the mid-latitudes? Is there a quick and simple way to figure our rotation speed? Yes, all you need is a calculator to convert the cosine of you latitude. On the diagram below, the North Pole is the blue pushpin. The red arrows are all on the 45 degrees parallel, showing the direction of rotation. Now, however, we are on a small circle because the meridians converge! What is the distance between one degree of longitude at latitude 45 degrees?



Cosine of (latitude) $45 \times 69 =$ to get the one mile distance, or
 $0.70711 \times 69 = 48.79$ miles; then to get total miles of the small circle:
 $360 \times 48.79 = 17,564.5$ total miles in one rotation at 45 degrees latitude, therefore to
calculate speed: $17,564.5 / 24 = 732$ mph

Don't trust my cosine method? What is the cosine of the Equator at 0 degrees latitude?

(Answer is 1)

$$1 \times 69 = 69$$

At the Poles, how fast do you rotate? What is the cosine of 90 degrees?

(Answer is zero).

$$0 \times 69 = 0$$

This is really just a quick method to determine an *approximation*, but it does demonstrate a few concepts that are sometimes difficult to grasp. (Later on in my Climate and Water course this is useful for illustrating the 'Coriolis Affect' the breakdown of higher altitude wind creating Hadley circulation associated with the trade winds and subtropical high pressure cells).

Teaching my kids to drive at home, I always remind them that they drive way too fast. When they argue with me, I try to explain that 700 mph will get them there in plenty of time and try to explain something of the above They roll their eyes, thinking "... poor Dad, what a nerd ...". That's the cleaned up version, anyway.