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PH108 : Electricity & Magnetism

Weekly Quiz 1 - Mercator charts and flat maps

24 January, 2018

Instructions: Read these before beginning!

1 Fill out the details carefully & correctly, else the quiz will NOT fetch you marks or attendance.

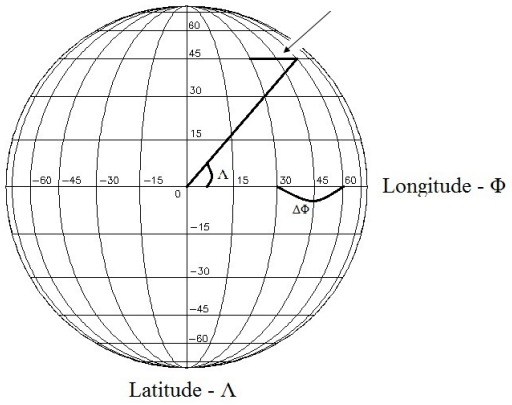
2 You have **5 min** to fill all the answer(s) at the specified location(s), for a total of **1 mark**.

3 There will be NO partial marking. Only answer(s) at specified location(s) will be considered.

4 Any sort of malpractice will be strongly penalised!

Question

Projecting a 3-D earth on 2-D paper can be done in two ways. One of them is shown below. The goal is to find the second one, which is used in atlas maps. (Don't worry, we're here to help.)



Consider the distance between two longitudes, separated by $\Delta\Phi$, at the latitude Λ, ALONG the latitude (like the bold line indicated by the arrow). This is clearly different from the distance between the two longitudes at the equator. Find the ratio of the two distances (on Earth). Hint: distances in plane of the latitudes.

$\frac{\text{distance at latitude } \Lambda}{\text{distance at equator}} =$ (in terms of Λ and $\Delta\Phi$) [$\frac{1}{2}$ **mark**]

Scaling (dividing) distances at every latitude by this factor, for that latitude, will sort of flatten out the surface, creating the square grids of latitude and longitude we see in atlas maps.

A problem will occur when the factor goes to zero. It can be solved easily though (maps of every place exist!). Can you think of a method? (Even if you can't, hints will take you there...)

Hint 1 (physical): Change the 'view', repeat the process (Symmetric Earth here).
Hint 2 (mathematical): A similar function which does the same job.

Either hint points to the same transformation of a variable (Λ or Φ, say):

_____ → _____ [$\frac{1}{2}$ **mark**]

————————Question Ends Here————————

P.S.: For more information, read about 'Nautical Mile'.