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# PH108 : Electricity & Magnetism

## Weekly Quiz 2 - Use of Variable Unit Vectors

31 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**.

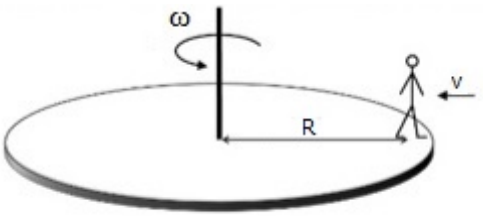
3) There will be NO partial marking. Only answer(s) at specified location(s) will be considered.

4) Any sort of malpractice will be strongly penalised!

All the Best! Use the backside for rough work.

***Question***

Unit vectors in Cartesian co-ordinates are 'constant'. In cylindrical and spherical co-ordinates, they vary with space (as you have already seen). Let's consider a scenario where they vary with time.




Consider a man walking towards the center of a turntable (rotating with angular velocity $\omega$) uniformly with a speed v in the turntable's frame (plane polar), from the point (r=R, $\theta$=0) at t=0.

Write down the position of the man at any time t in the rotating frame (in terms of v, $\hat{r}$ and $\hat{\theta}$)

$\mathbf{r} =$ [$\frac{1}{2}$ **mark**]

Here, $\hat{r}$ and $\hat{\theta}$ change with time! Write them in terms of $\hat{\imath}$ and $\hat{\jmath}$ (in the inertial frame), assuming that at t=0, the x-axis is at $\theta$=0 (using $\omega$...).

Find acceleration using this, in the inertial frame.

One term in $\mathbf{a}$ will be the centrifugal acceleration (of the form, $-\omega^2\mathbf{r}$). Write out the other (in terms of v, $\omega$, $\hat{r}$ and $\hat{\theta}$)

$\mathbf{a} + \omega^2\mathbf{r} =$ [$\frac{1}{2}$ **mark**]

This is the famous phenomenon, the Coriolis effect!

————————Question Ends Here————————

P.S.: For more information, read about 'Trade-winds and Westerlies'.