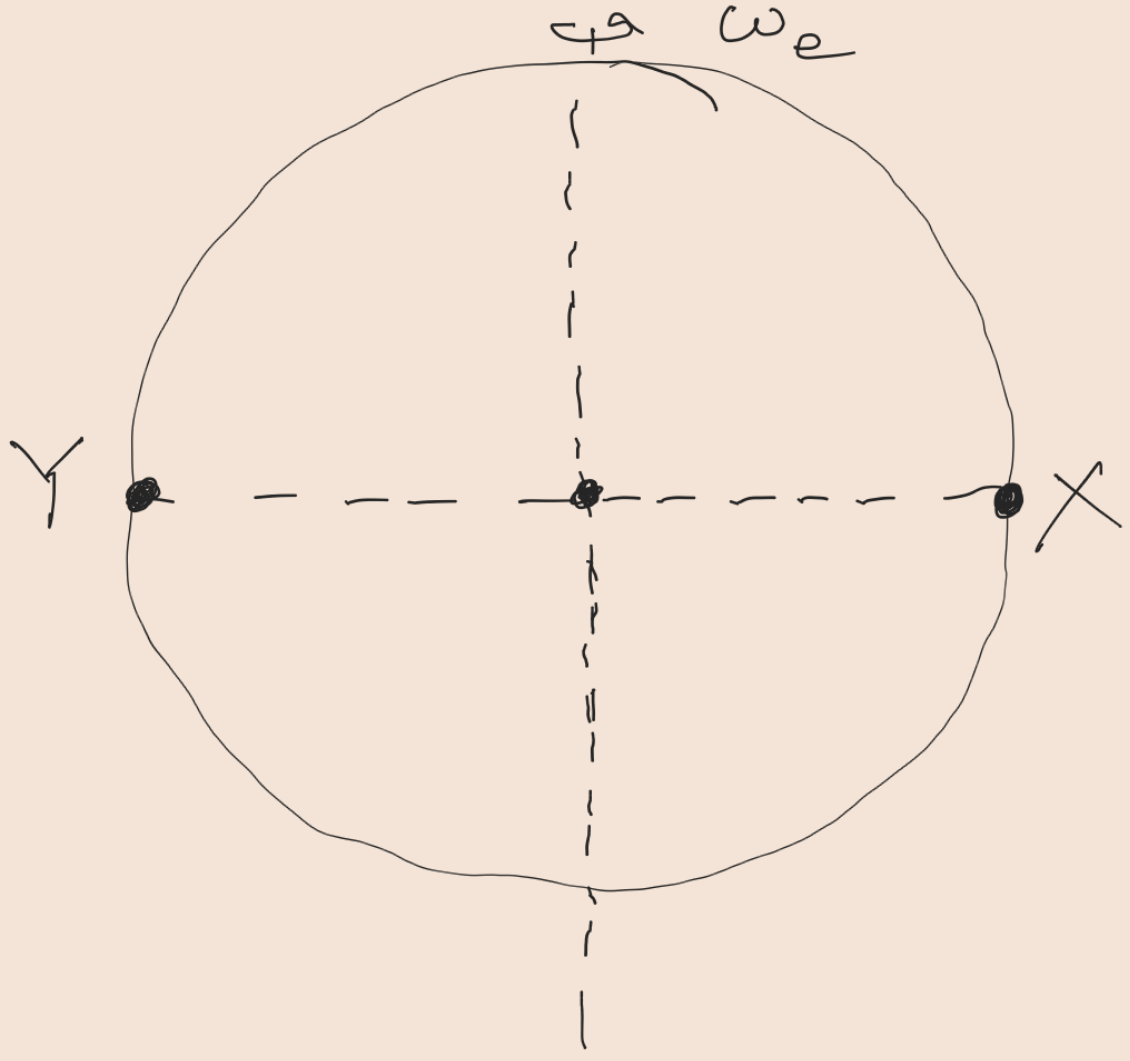


Let us go to the earth's rotating reference frame. Wrt this frame, a centrifugal force of $(\omega_e^2 R_e)$ will be added outwards to any object. Now, $2\pi\sqrt{\frac{l}{g}}$ must correspond to

one second for a second's pendulum. Let the angular speed of aircraft moving along earth rotation sense be ω_1 & the opposite one be ω_2. Then, $(\omega_1 + \omega_e)$ $= \omega_2 - \omega_e$. Also,

$$\frac{\pi}{\omega_1 + \omega_e} = \frac{\pi}{\omega_e} \; ; \; \boxed{\omega_1 = 0}$$

$$\frac{\pi}{\omega_2 - \omega_e} = \frac{\pi}{\omega_e} \; ; \; \boxed{\omega_2 = 2\omega_e}$$

$$T_1 = 2\pi\sqrt{\frac{l}{g}} \; ; \; T_2 = 2\pi\sqrt{\frac{l}{g - \omega_2^2 R}}$$

$$T_2 = 2\pi\sqrt{\frac{l}{g}}\left[1 - \frac{4\omega_e^2 R}{g}\right]^{-\frac{1}{2}}$$

$$\simeq 2\pi\sqrt{\frac{l}{g}}\left(1 + \frac{2\omega_e^2 R}{g}\right).$$

Hence, the difference of time displayed per second will be

$$T_2 - T_1 = \left(2\pi\sqrt{\frac{l}{g}}\right) \times \left(\frac{2\omega_e^2 R}{g}\right)$$

The total difference of time will be

$$\left(2\pi\sqrt{\frac{l}{g}}\right)\left(\frac{2\omega_e^2 R}{g}\right) \times \frac{\pi}{2\omega_e}.$$

Actual time taken is $\frac{\pi}{2\omega_e}$, which can also be expressed as $\frac{\pi}{2\omega_e} \times 2\pi\sqrt{\frac{l}{g}}$, as $2\pi\sqrt{\frac{l}{g}}$ is one second. So required ratio is

$$\frac{2\pi\sqrt{\frac{l}{g}}\left(\frac{2\omega_e^2 R}{g}\right) \times \frac{\pi}{2\omega_e}}{2\pi\sqrt{\frac{l}{g}} \times \frac{\pi}{2\omega_e}} = \frac{2\omega_e^2 R}{g}$$