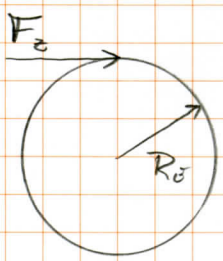
DRONE PR 9.11

ZORCH SLOWS EARTH'S ROTATION TO $T = 28\,h$ WITH $F = 4\times10^{7}\,N$. HOW LONG WILL IT TAKE?



FIND THE TORQUE

$$\Sigma\tau = I_E\alpha_z$$

$$R_E F_z = I_E\alpha_z = \frac{2}{5}M_E R_E^2\alpha_z$$

$$\alpha_z = \frac{5F_z}{2M_E R_E}$$

SINCE F_z IS CONSTANT, α_z IS CONSTANT

$\Rightarrow$ USE KINEMATICS

$$\omega = \omega_0 - \alpha_0 t$$

$$\Rightarrow t = \frac{\omega_0 - \omega}{\alpha_z}$$

$$\omega_0 - \omega = \left(\frac{1\,REV}{24\,h} - \frac{1\,REV}{28\,h}\right)\left(\frac{2\pi\,RAD}{REV}\right)\left(\frac{1\,h}{3600\,s}\right)$$

$$\omega_0 - \omega = 1.039\times10^{-5}\,RAD/s$$

$$\alpha_z = \frac{5(4\times10^{7})}{2(5.98\times10^{24})(6.37\times10^{6})} = \frac{20\times10^{7}}{7.62\times10^{31}}$$

$$\alpha_z = 2.63\times10^{-24}$$

$$t = \frac{1.039\times10^{-5}}{2.63\times10^{-24}} = 3.96\times10^{18}\,SEC\left(\frac{h}{3600\,s}\right)\left(\frac{d}{24\,h}\right)\left(\frac{yr}{365\,d}\right)$$

$$t = 1.26\times10^{11}\,yr = \boxed{126\,Gyr = t}$$