More Orbital Motion

$$a_{centripetal} = a_{grav}$$

$$\frac{v^2}{r} = \frac{GM}{r^2}$$

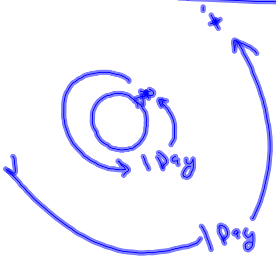
$$V = \sqrt{\frac{GM}{r}}$$

$$g = 9.8\,m/s^2 = \frac{GM}{R_e^2}$$

$$g = \frac{GM}{(R_e + h)^2}$$

$$\boxed{g = \frac{GM}{r^2}}$$

Geosynchronous Satellite



$T = 1$ day

$r = ?$

orbital period = Earth's rotational period

$$v = \sqrt{\frac{GM}{r}}$$

$$T = \frac{2\pi r}{v}$$

$$= 2\pi r \sqrt{\frac{r}{GM}}$$

$$= \frac{2\pi r^{3/2}}{\sqrt{GM}}$$

$$\frac{\sqrt{GM}}{2\pi} T = r^{3/2}$$

$$\left(\frac{(GM)^{1/2}}{2\pi}\right)^{2/3} T^{2/3} = r$$

$$\frac{(GM)^{1/3}}{(2\pi)^{2/3}} T^{2/3} = r$$

$$\frac{\left(6.67\times10^{-11}\,\frac{Nm^2}{kg^2} \times 5.99\times10^{24}\,kg\right)^{1/3}}{(6.28)^{2/3}}$$

$$\times\,(24\cdot3600\,s)^{2/3} = 4.23\times10^{7}\,m$$

$$\left[\left(\frac{Nm^2}{kg^2}\,kg\right)^{1/3} s^{2/3}\right] = [m]$$ correct dimension ✓

Sep 25-1:24 PM