PP|580

7.

$m_1' = 14.7\, m_1$

$r' = 4.3\, r$

$F_g' = ??$

$$F_g = \frac{G m_1 m_2}{r^2} \quad (\text{on Earth})$$

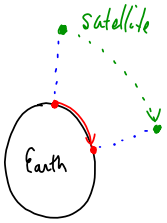
$$F_g' = \frac{G(14.7 m_1) m_2}{(4.3r)^2}$$

$$F_g' = \frac{14.7}{(4.3)^2} \frac{G m_1 m_2}{r^2} \leftarrow F_g$$

$$F_g' = \frac{14.7}{(4.3)^2} F_g$$

$$F_g' = 0.80\, F_g$$

§12-2 Planetary + Satellite motion



Geosynchronous or geostationary
- the satellite is always directly above a certain spot on the Earth.
- the period of such a satellite must match the period of the Earth's rotation on its axis (ie. 24h)

mp/589

geostationary
↓
$T = 24\,h$

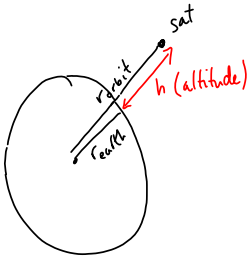
$m_{earth} = 5.98 \times 10^{24}\,kg$

$r_{earth} = 6.38 \times 10^{6}\,m$

$h = ?$

$(r_{orbit} = ?)$

$v = ??$



$F_g = F_c$

$$\frac{G m_{earth} m_{sat}}{r^2} = \frac{m_{sat} 4\pi^2 r}{T^2}$$

$$G m_{earth} T^2 = 4\pi^2 r^3$$

$$r^3 = \frac{G m_{earth} T^2}{4\pi^2}$$

$$r^3 = \frac{\left(6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}\right)\left(5.98 \times 10^{24}\,kg\right)\left(24 \times 3600\,s\right)^2}{4\pi^2}$$

$r = 4.23 \times 10^{7}\,m$

0.638×10^{7}

$h = 4.23 \times 10^{7}\,m - 6.38 \times 10^{6}\,m$

altitude.

$h = 3.58 \times 10^{7}\,m$

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

radius of satellite's orbit.

$$v = \frac{2\pi (4.23 \times 10^{7}\,m)}{(24 \times 3600\,s)}$$

$v = 3.08 \times 10^{3}\,m/s$

To DO

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Assignment (due Thurs) - p597/22 - 33