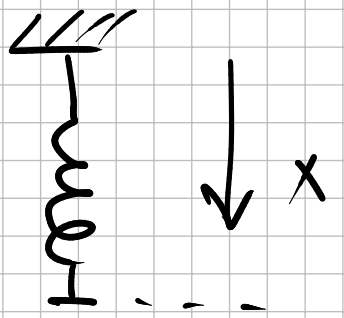
$$E_{Total} = K + U$$

conserved iff there are no work by non-conservative forces

$$E = \frac{mv^2}{2} + mgy$$

Springs



$F_{spring} = mg = -k\,\Delta x$

represent tendency to undo

spring constant

$F_{sp} = -kx$

↖ counted from unstretch condition

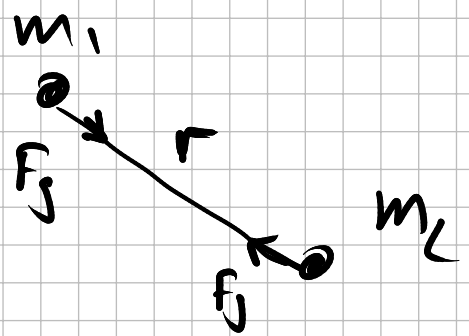
$$W_s = \int_{x_A}^{x_B} (-kx)\,dx = -k\frac{x^2}{2}\Big|_{x_A}^{x_B}$$

$$= -k\,\frac{x_B^2}{2} - (-)\frac{kx_A^2}{2}$$

$$\boxed{U_s = k\frac{x^2}{2}}$$

Universal law of Gravity

$$F_g = G \frac{m_1 \cdot m_2}{r^2}$$

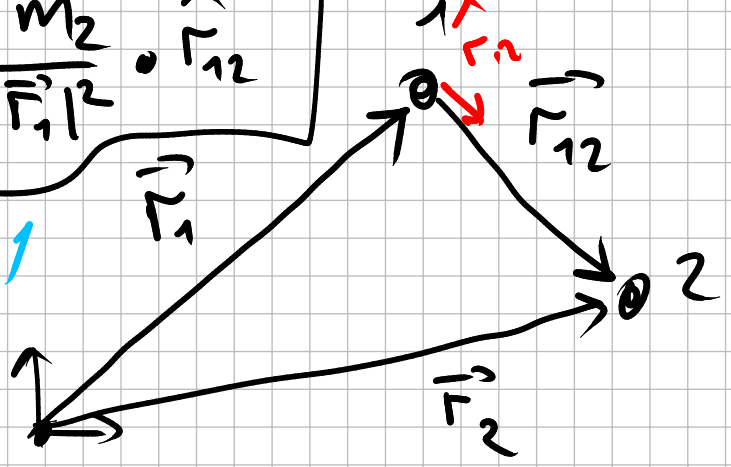


gravitational constant

$$G = 6.67 \cdot 10^{-11} \left[\frac{N}{kg^2} \cdot m^2\right]$$

$$\vec{F}_{g12} = G \frac{m_1 m_2}{|\vec{r}_2 - \vec{r}_1|^2} \cdot \hat{r}_{12}$$

force on the body 1 from second



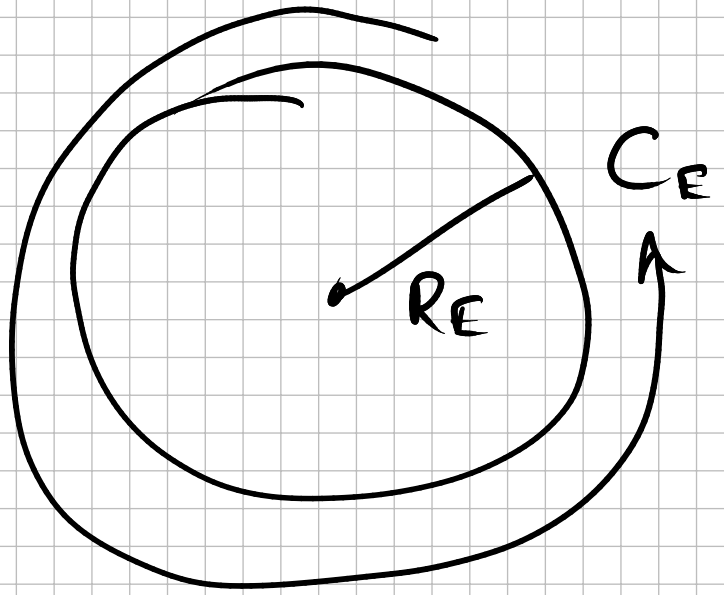
$$\vec{r}_{12} = \vec{r}_2 - \vec{r}_1$$

$$\frac{\vec{r}_{12}}{|r_{12}|} = \hat{r}_{12}$$

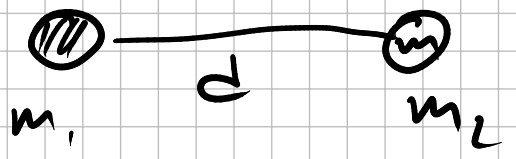
$$F_g = mg$$

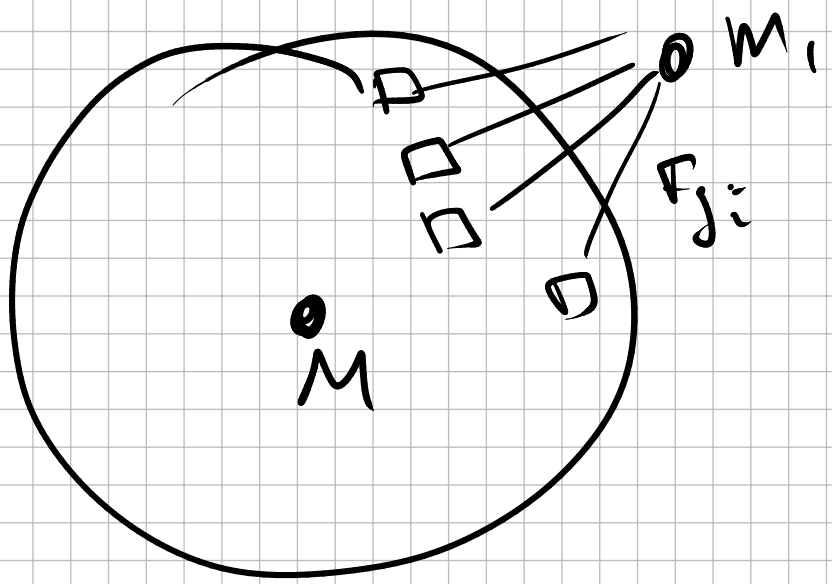
$$g = \frac{F_{gE}}{m} = \frac{G \cancel{m} \cdot M_E}{\cancel{m} \cdot R_E^2}$$

$$\boxed{g = G \frac{M_E}{R_E^2}}$$



$$1m = \frac{C_E}{4 \cdot 10\,000\,000}$$




M
M1
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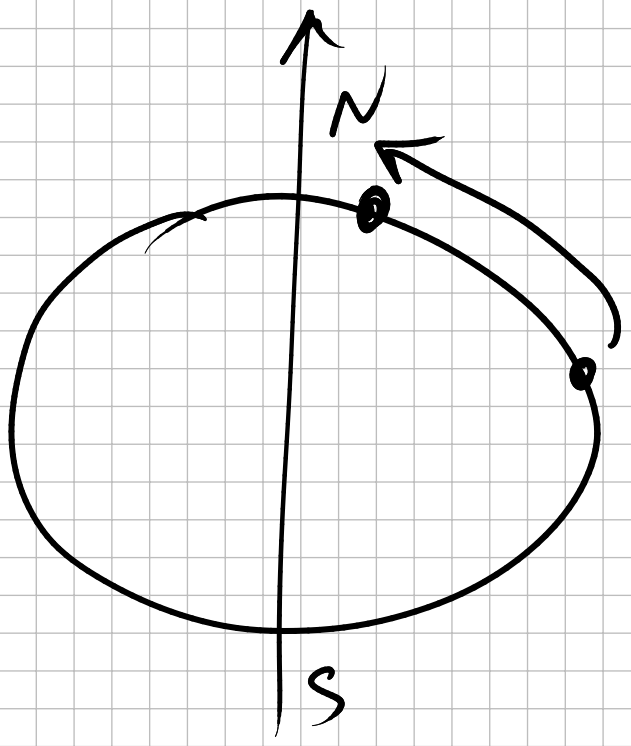
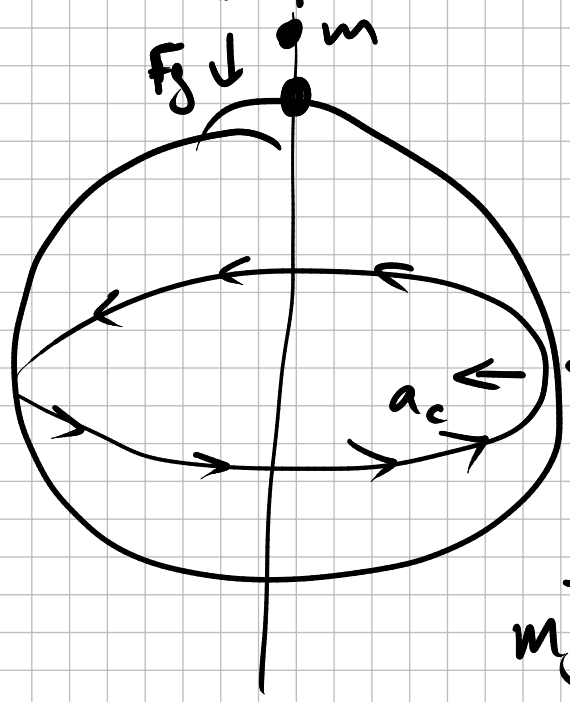


W - ?



$W = T_p = mg$

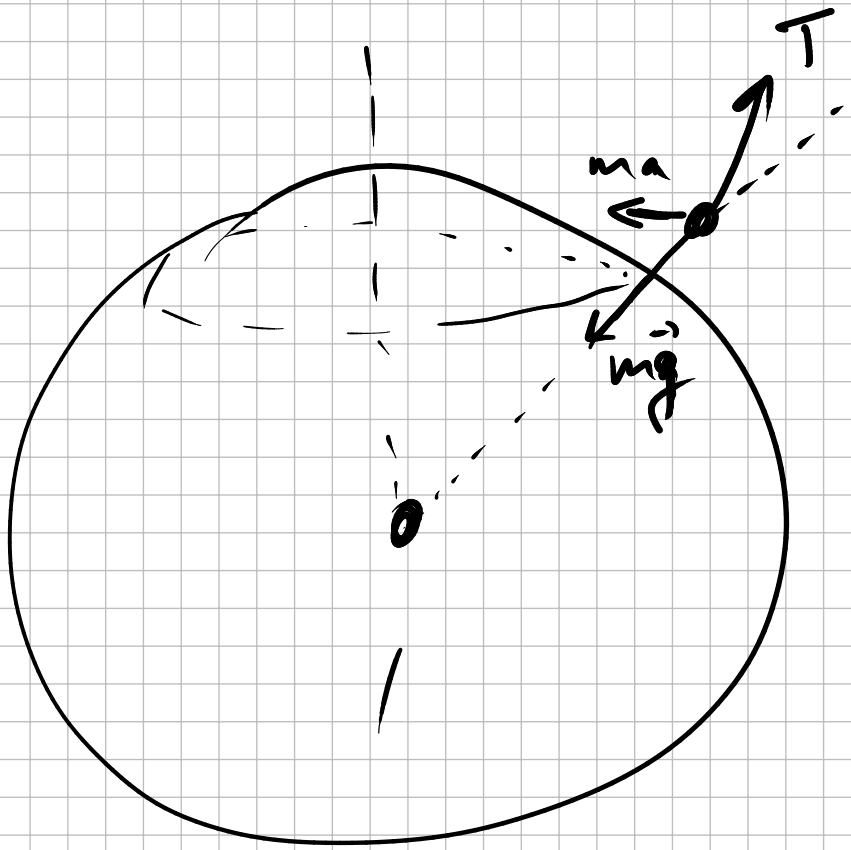
$m\vec{g} + \vec{T}_E = m\vec{a}$

$= m\vec{a}_c$

$$-m a_c = -mg + T_E$$

$$-m \cdot \frac{v^2}{R_E} = -mg + T_E \Rightarrow \boxed{T_E = mg - \frac{mv^2}{R_E}}$$

$v \simeq 450\,m/s$


T
ma
mg
O