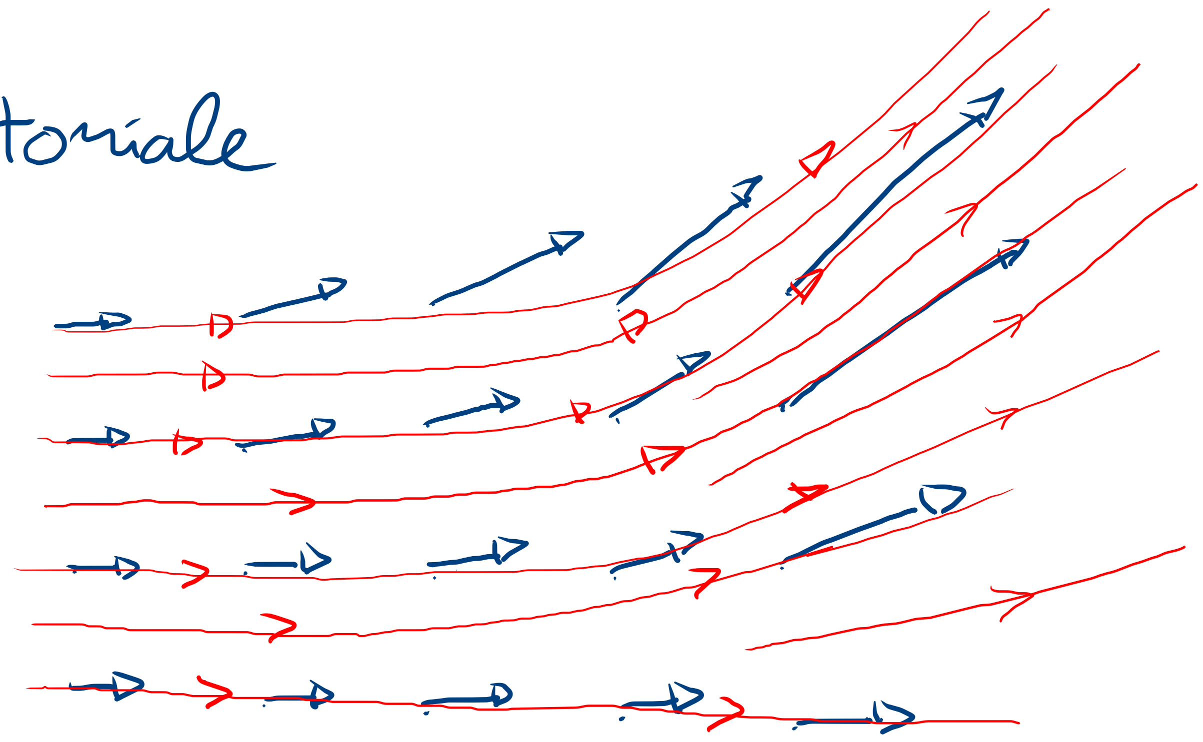
APPROFONDIMENTO 1 : CAMPO DI FORZE

Campo vettoriale



① rappresentazione "per punti"

② rappresentazione "per linee di forza"

l'intensità della forza si rende con la densità delle linee di forza

FORZA DI LORENTZ

$\vec{E}(\vec{r};t)$

$\vec{B}(\vec{r};t)$

Forza di Lorentz : carica q

velocità $\vec{v}$

$$\boxed{\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)}$$

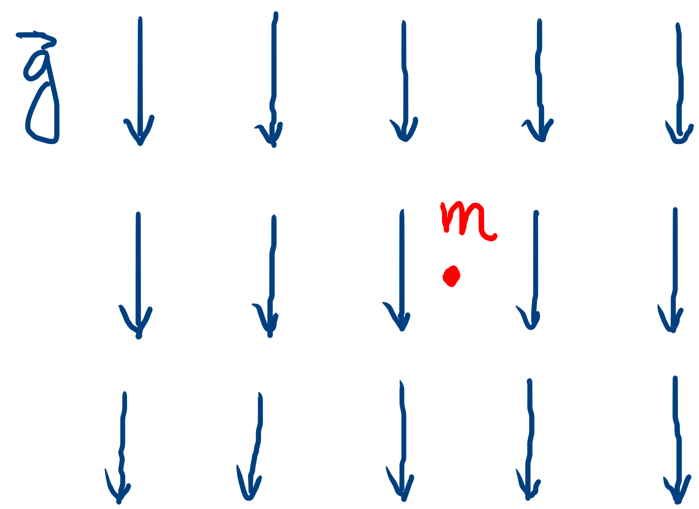
se $\vec{B} = 0$

$$\vec{F} = q\vec{E}$$

FORZA PESO

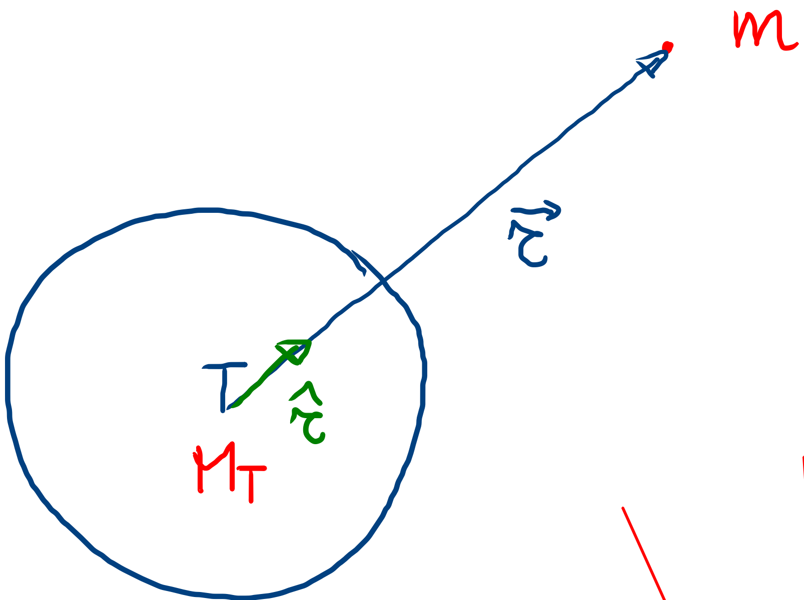
$$\vec{P} = m\vec{g}$$

Esiste un campo vettoriale costante $\vec{g}$



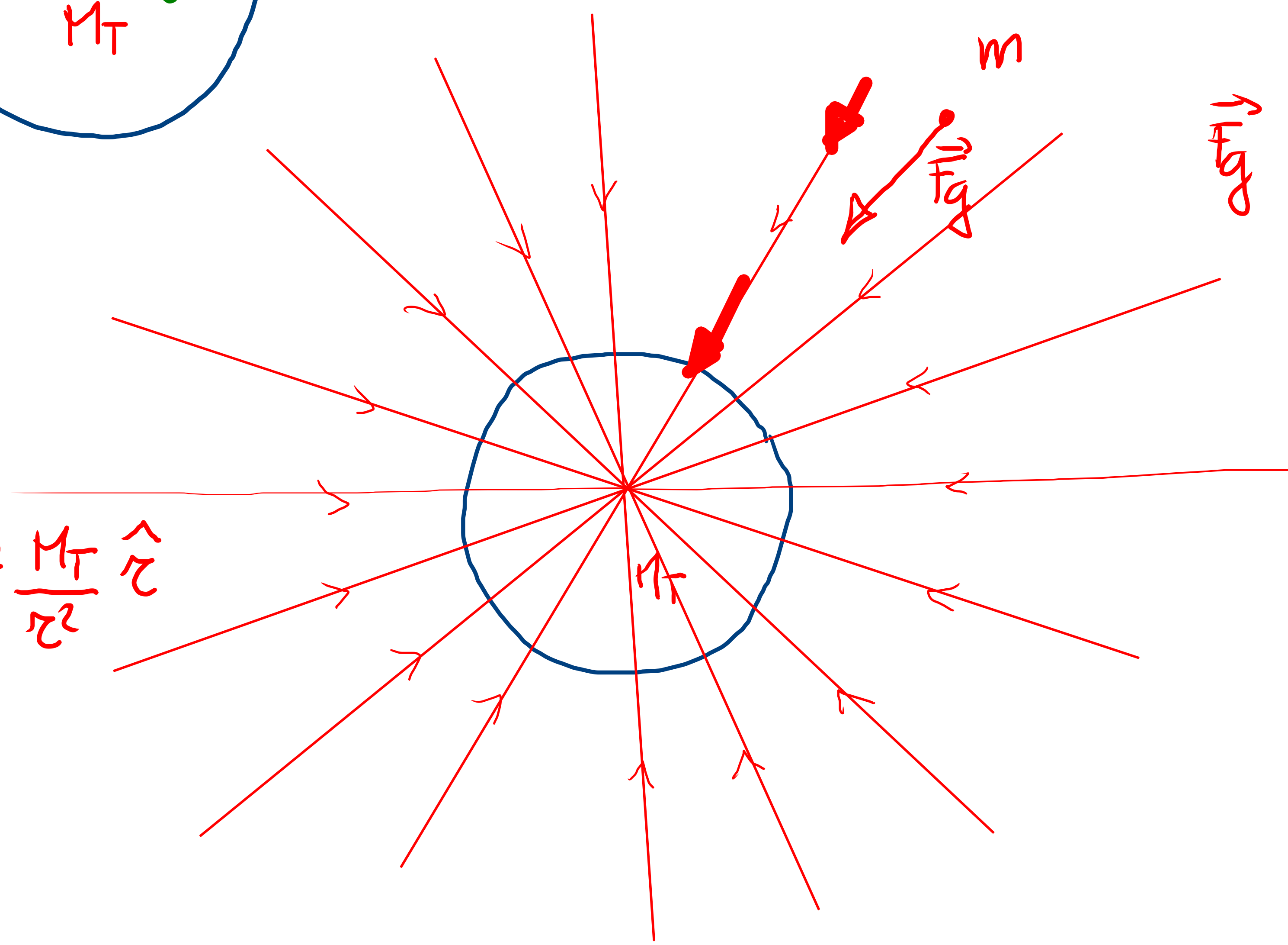
$$\Rightarrow \quad \vec{P} = m\vec{g}$$

FORZA GRAVITAZIONALE



$$\vec{F}_g = -G\,\frac{M_T \cdot m}{r^2}\,\hat{r}$$

$$\hat{r} = \frac{\vec{r}}{r}$$



$$\vec{F}_g = m \cdot \left(-\frac{G M_T}{r^2}\,\hat{r} \right)$$

$$-G\,\frac{M_T}{r^2}\,\hat{r}$$

ENERGIA POTENZIALE & CAMPI DI FORZE

$$\mathcal{L} = -\Delta U$$

In 1D, $\mathcal{L} = F \cdot \Delta x$ (F e Δx paralleli)

$$F \cdot \Delta x = -\Delta U$$

$$F = -\frac{\Delta U}{\Delta x}$$

$\lim_{\Delta x \to 0}$ $$F = -\frac{dU}{dx}$$

In 3D, $$\vec{F} = -\left(\frac{\partial U}{\partial x}\hat{i} + \frac{\partial U}{\partial y}\hat{j} + \frac{\partial U}{\partial z}\hat{k} \right)$$

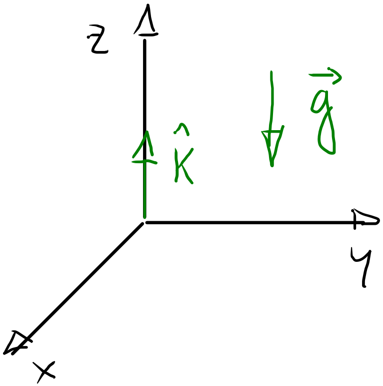
$$\vec{F} = -\overline{\text{grad}}\, U = -\nabla U$$

campo vettoriale

U è un campo scalare

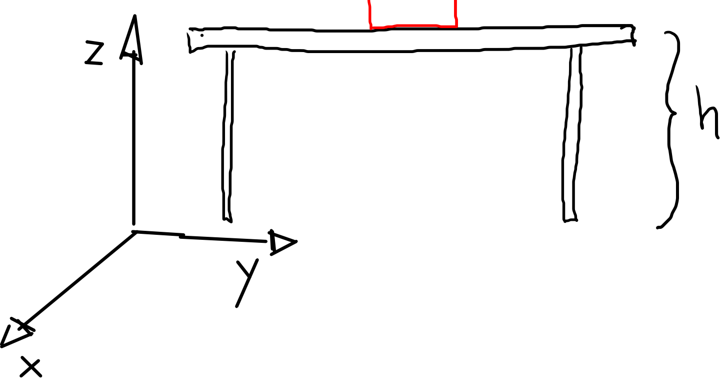
definisce uno scalare in ogni $\vec{r}$ ed in ogni t

ESEMPIO: forza peso e $U = mgz$



$$\vec{F} = -\vec{\nabla} U$$
$$= -\left(\frac{\partial U}{\partial x}\hat{i} + \frac{\partial U}{\partial y}\hat{j} + \frac{\partial U}{\partial z}\hat{k} \right)$$
$$= -\left(0 + 0 + mg\,\hat{k} \right)$$
$$= -mg\,\hat{k} = m\vec{g}$$

$\Sigma\vec{F} = 0$



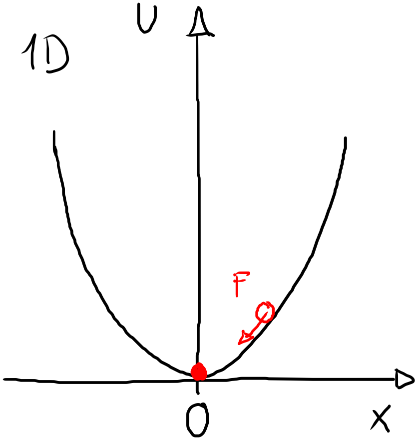
$$U = mgz \Big|_{z = \text{cost} = h} = mgh$$

$$\vec{F} = -\vec{\nabla}\bar{U}$$
$$= -(0 + 0 + 0) = 0$$

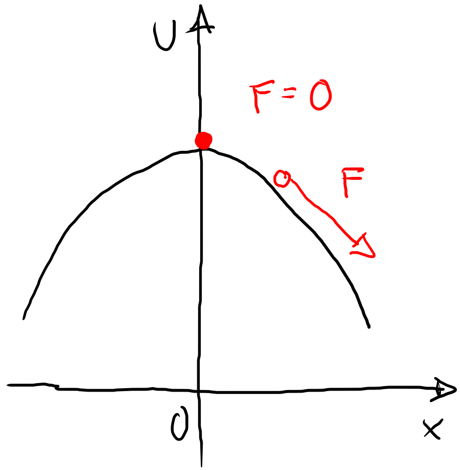
EQUILIBRIO

$F = -\bar{\nabla} U$

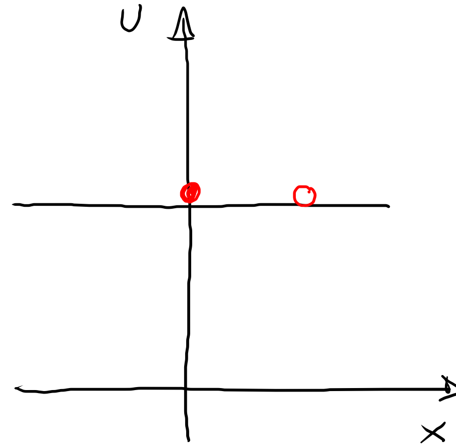
in 1D



eq. stabile



eq. instabile



eq. indifferente