Conservative:- gravitational, electr., spring force etc.

Non-conservative:- friction, air. Resistance, the forces which depend upon Vel.

$$\boxed{W_c = -\Delta U}$$

$$dW_c = -dU$$

$$F \cdot dx = -dU$$

$$\boxed{F = -\frac{dU}{dx}}$$

$$\boxed{\vec{F} = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j} - \frac{\partial U}{\partial z}\hat{k}}$$

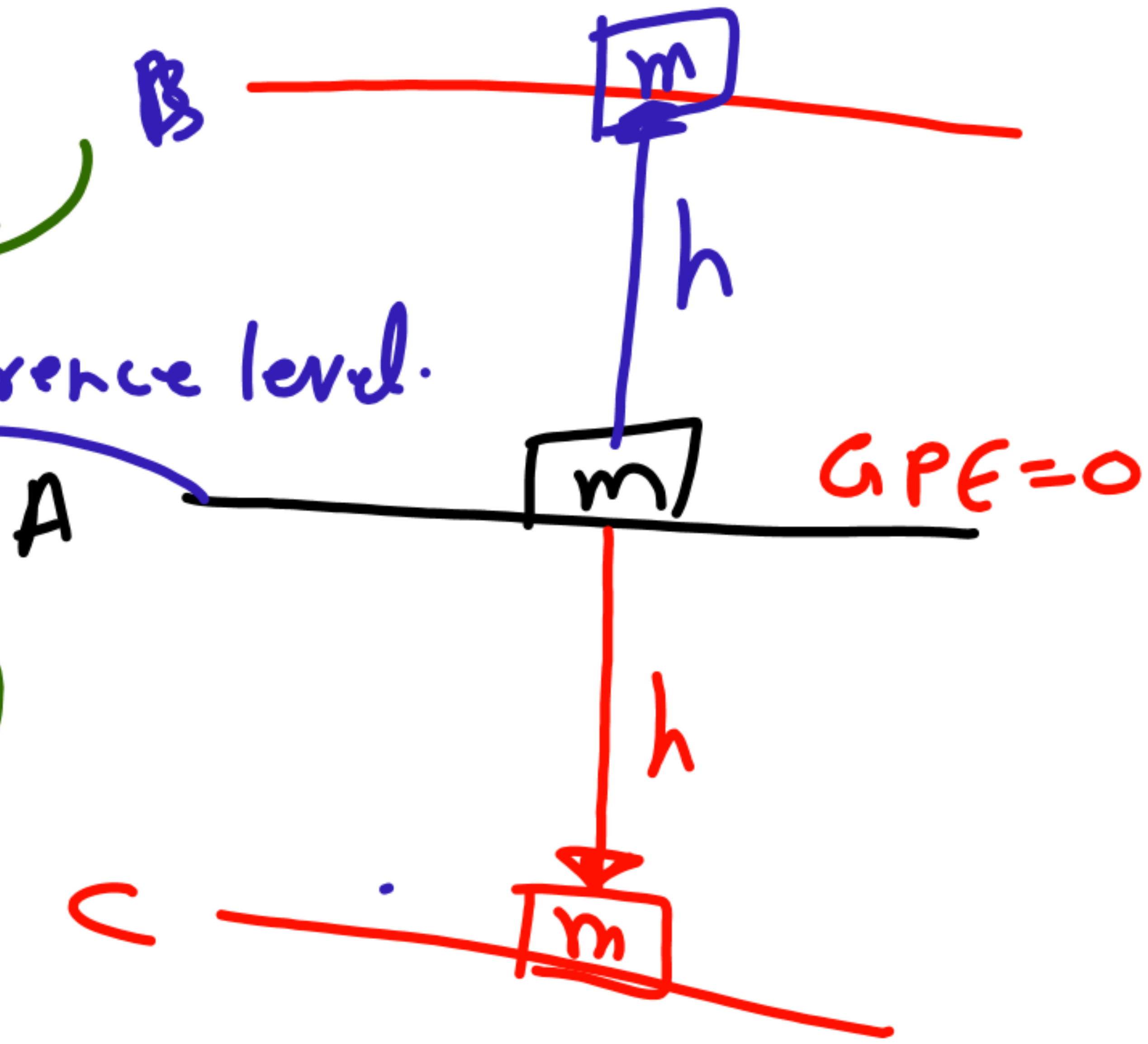
gravitational P.E :-

$W_c = U_i - U_f$

$+mgh = U_A - U_C$

$\boxed{U_C = \cancel{U_A} - mgh}$ $\rightarrow 0$

$\boxed{U_C = -mgh}$



$W_c = -\Delta U$

$W_c = U_i - U_f$

$-mgh = U_A - U_B$

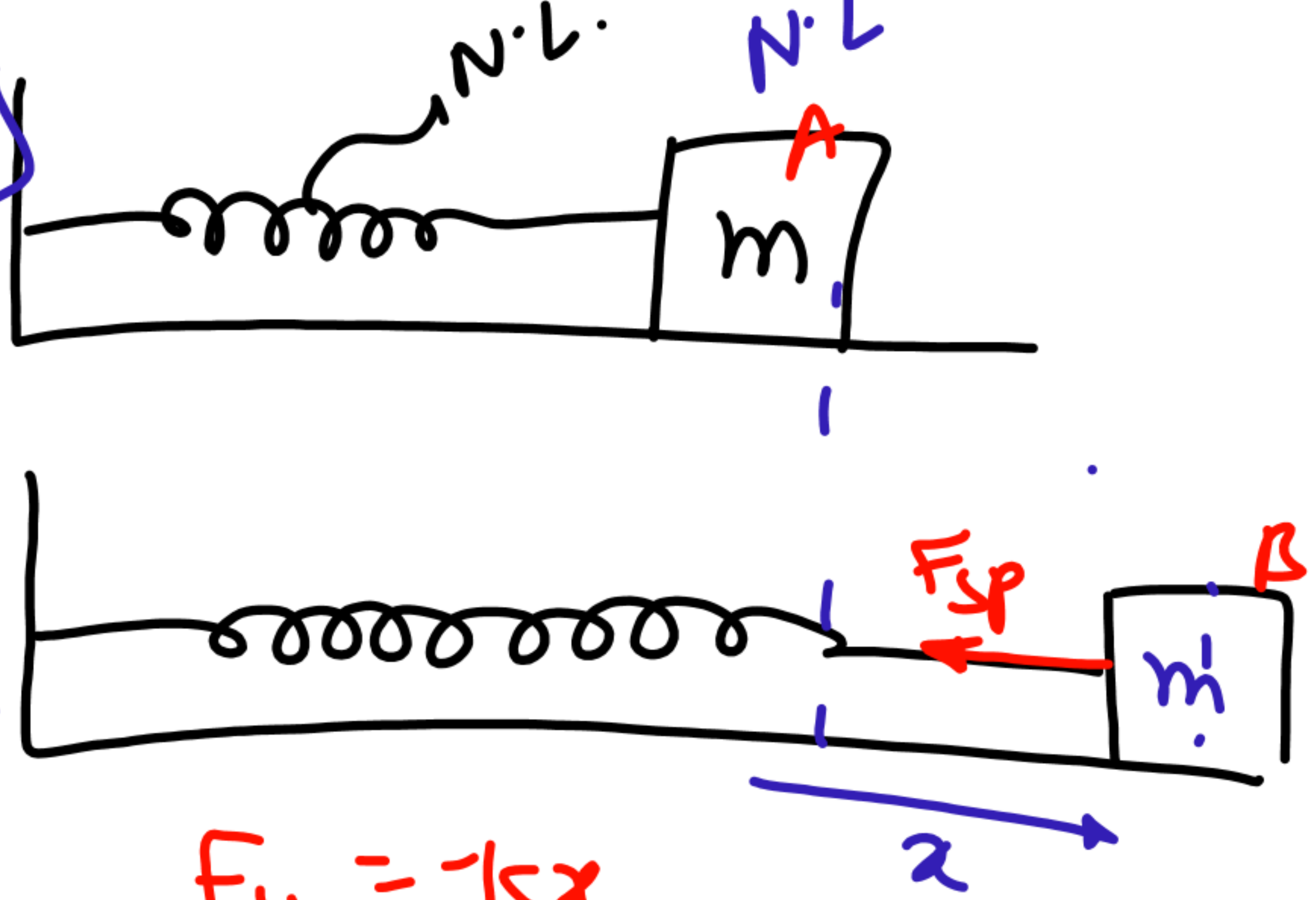
$\boxed{U_B = \cancel{U_A} + mgh}$ $\rightarrow 0$

$\boxed{U_B = +mgh}$

Spring P.E.:-

$$\boxed{U = \frac{1}{2}kx^2}$$

'x' is measured from N.L



$$F_{sp} = -kx$$

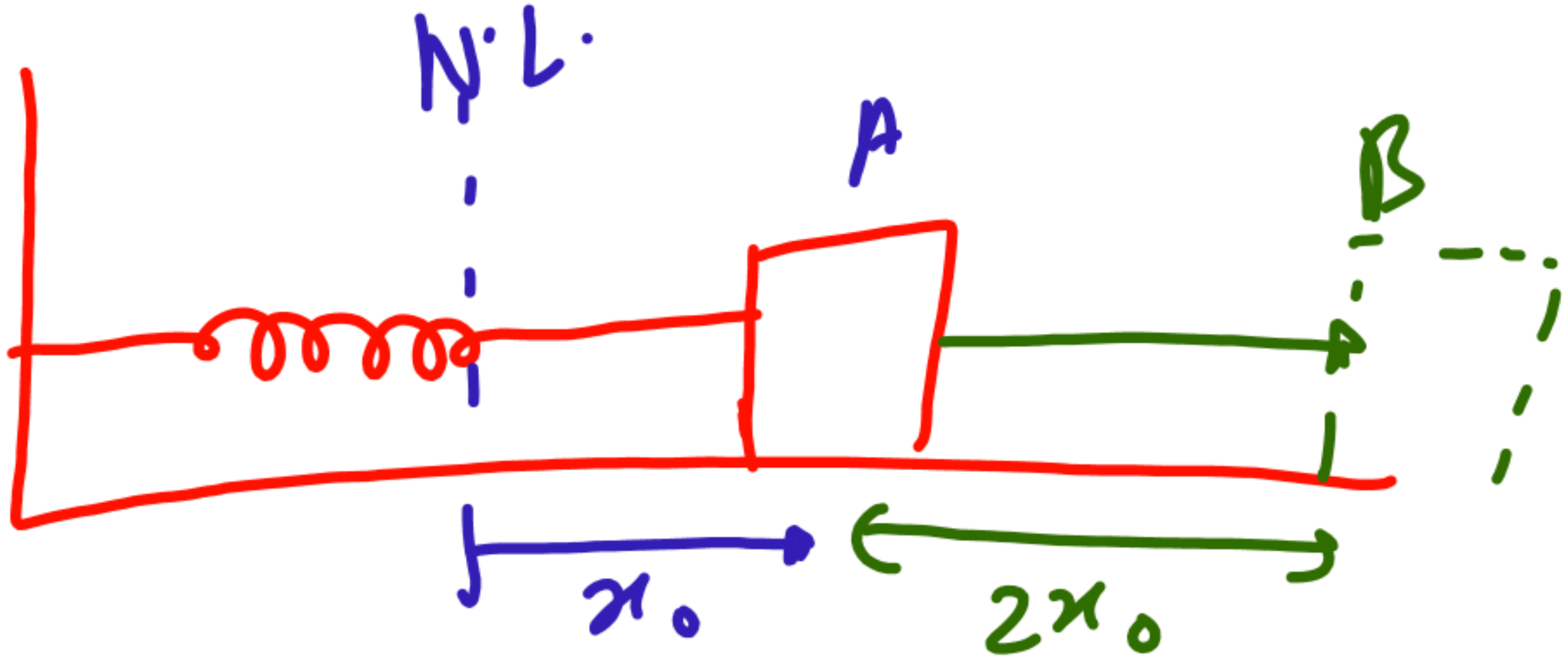
$$W_c = U_i - U_f$$

$$\int F_{sp}\,dx\,\cancel{\cos 180}^{\,-1} = U_A - U_C$$

$$-\int_0^x kx\,dx = U_{N.L} - U_x$$

$$\boxed{U_x = \underbrace{U_{N.L}}_{0} + \frac{1}{2}kx^2}$$

$$\boxed{U_x = \frac{1}{2}kx^2}$$



$$\left(W_{sp}\right)_{A \to B} = U_i - U_f$$

$$= \frac{1}{2}kx_0^2 - \frac{1}{2}k(3x_0)^2$$

$$\Rightarrow -4kx_0^2$$

$U = x^2 + y^2 + z^2$

find force at $(1, 1, 1)$

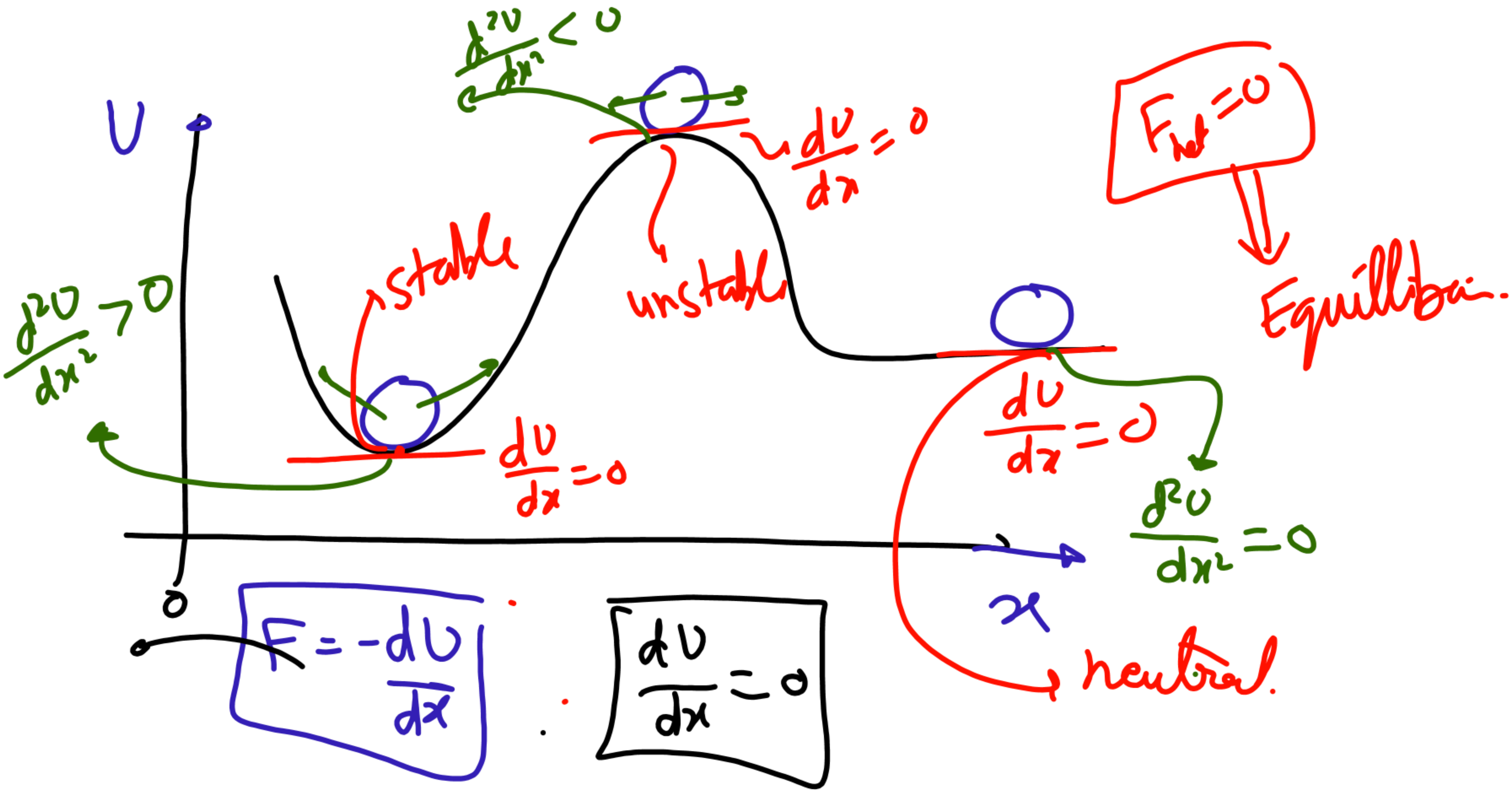
$$\vec{F} = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j} - \frac{\partial U}{\partial z}\hat{k}$$

$$\vec{F} = -2x\,\hat{i} - 2y\,\hat{j} - 2z\,\hat{k}$$

$$\vec{F} = -2\hat{i} - 2\hat{j} - 2\hat{k}$$

$$|\vec{F}| = \sqrt{2^2 + 2^2 + 2^2}$$

$$= 2\sqrt{3}\ N$$



$$\boxed{F = -\frac{dU}{dx}}$$

$$\therefore \quad \boxed{\frac{dU}{dx} = 0}$$

$U = x^3 - 27x + 4$

find Equillibrium Points & also find nature of Equill

$\frac{dU}{dx} = 3x^2 - 27 = 0$

$x^2 - 9 = 0$

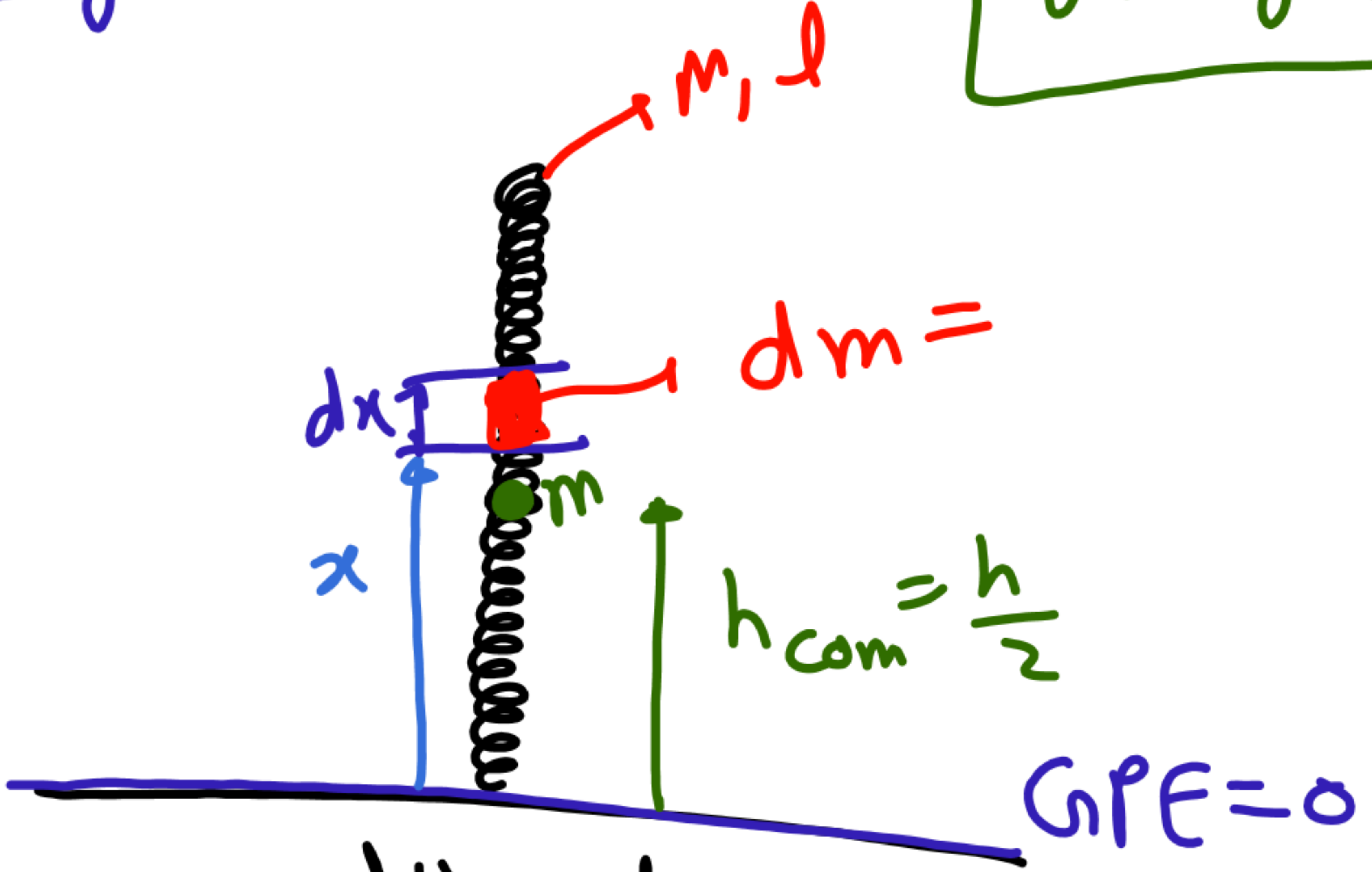
$x = +3$ — stable

$x = -3$ — unstable

$\frac{d^2U}{dx^2} = 6x$

P.E. of chain:-

$$\boxed{U = mgh_{com}}$$



$l \longrightarrow M$

$1 \longrightarrow \frac{M}{l}$

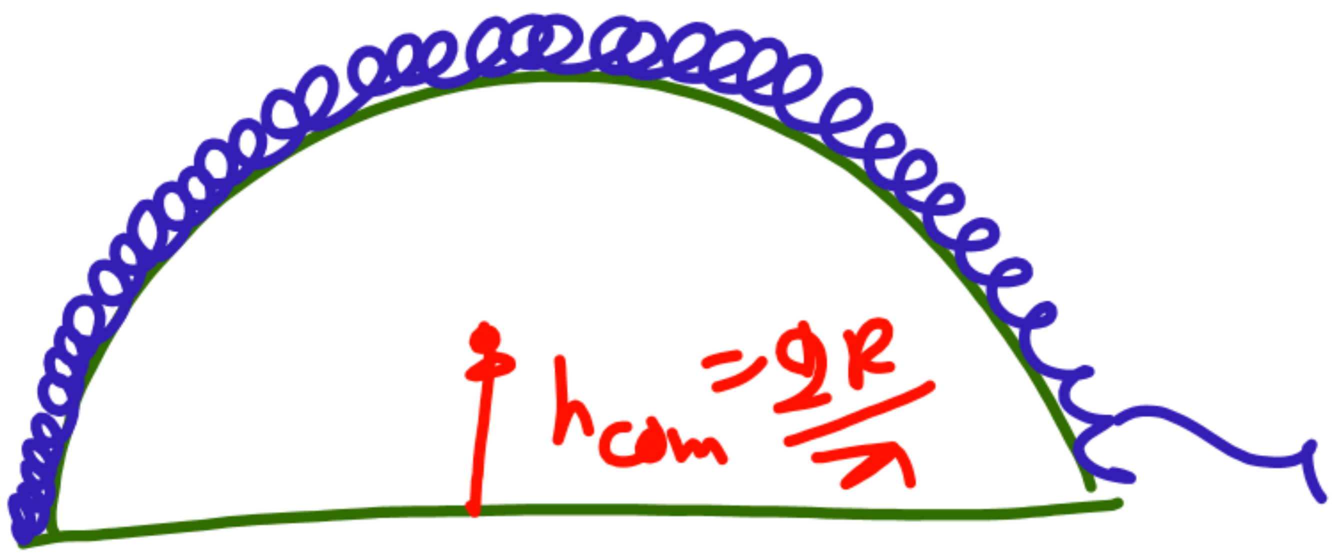
$dx \longrightarrow \frac{M}{l}dx$

$$dU = dm\,g\,x$$

$$\int dU = \int \frac{M}{l}\,dx\,g\,x$$

$$U = \frac{m}{l} g \int_0^l x\,dx$$

$$\boxed{U = \frac{mgh}{2}}$$



Semicircular / uniform mass dist.

$$U = mgh_{com}$$

$$U = Mg\left(\frac{2R}{\pi}\right)$$

$$U = \frac{2MgR}{\pi}$$