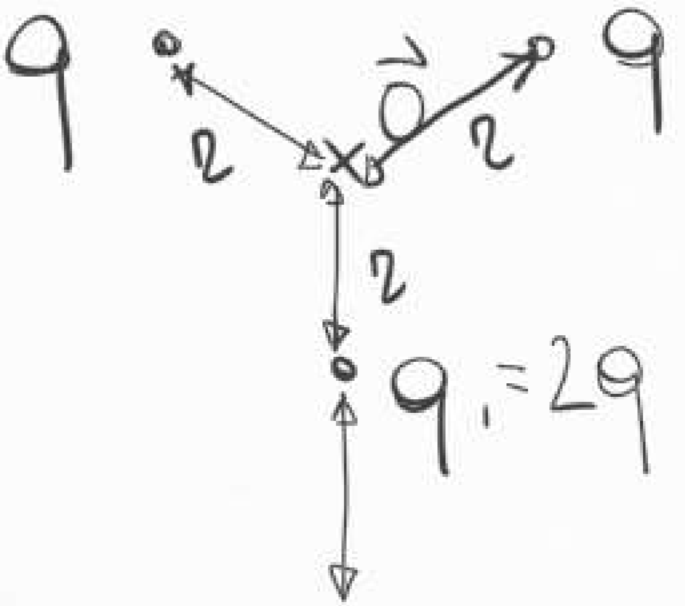
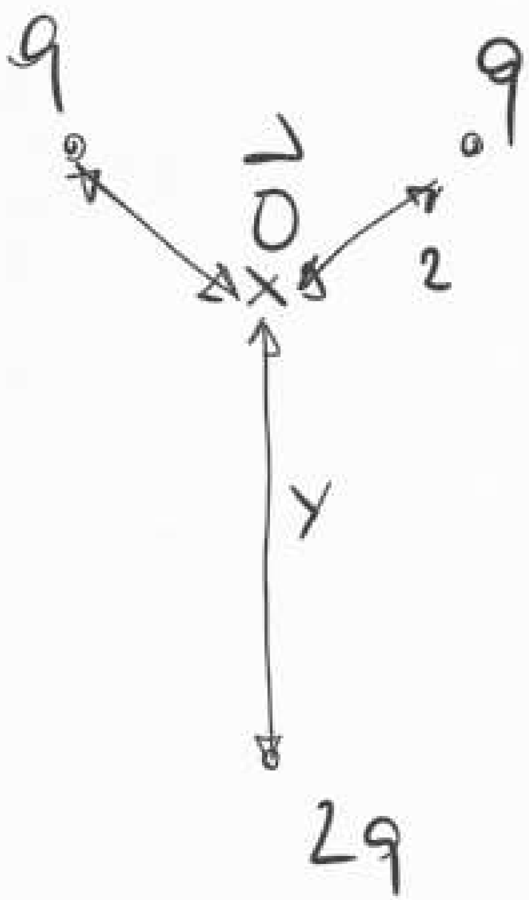


$$\vec{E} = \left(\boxed{\frac{q}{4\pi\varepsilon_0}\frac{1}{r^2}} \boxed{- \frac{q_1}{4\pi\varepsilon_0}\frac{1}{r^2}} \right)\hat{x} \quad (1)$$

$q_1 = 2q$ (2)

$$\boxed{\vec{E}(\vec{0}) = 0}$$

$$\boxed{-\frac{2q}{4\pi\varepsilon_0}\frac{1}{y^2}}$$



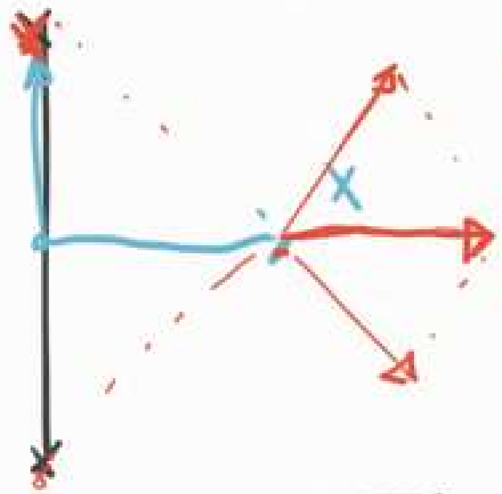
$$\frac{\cancel{q}}{\cancel{4\pi\varepsilon_0}}\frac{1}{r^2} = \frac{2\cancel{q}}{\cancel{4\pi\varepsilon_0}}\frac{1}{y^2} \Rightarrow y = \sqrt{2}\, r$$

R, q

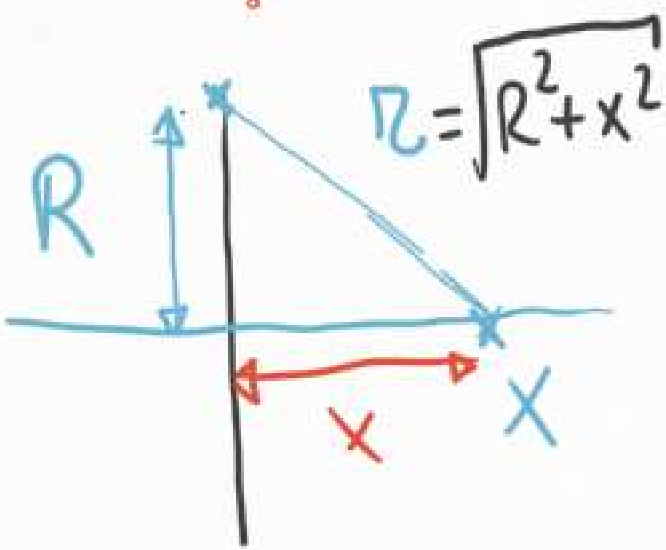
1) DISCUTERE IL CAMPO LUNGO $x \to \vec{E}(x,0,0) \parallel \hat{x}$

2) $\vec{E}(x,0,0) = ?$

$$\boxed{dE_x = \frac{dq}{4\pi\varepsilon_0}\,\frac{x}{r^3}} = \frac{dq}{4\pi\varepsilon_0}\,\frac{x}{(R^2+x^2)^{3/2}}$$

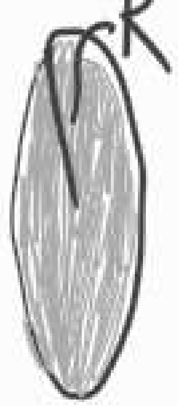


$$E_x = \int_{\text{ANELLO}} dE = \int_{\text{ANELLO}} \frac{dq}{4\pi\varepsilon_0}\,\frac{x}{(R^2+x^2)^{3/2}}$$



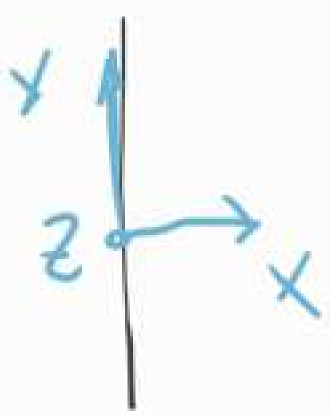
$$dq = \lambda\, dl, \quad \lambda = \frac{q}{2\pi R} \Rightarrow$$

$$E_x = \int_0^{2\pi R} \frac{dl\, q}{4\pi\varepsilon_0 2\pi R}\frac{x}{(R^2+x^2)^{3/2}} = \frac{\cancel{2\pi R}}{\cancel{2\pi R}}\frac{q}{4\pi\varepsilon_0}\frac{x}{(R^2+x^2)^{3/2}}$$



$$\vec{E}(x,0,0) = ? \qquad \vec{E}(x,0,0) \,//\, \hat{x}$$

$$dE_x = \frac{dq}{4\pi\varepsilon_0}\frac{x}{(r^2+x^2)^{3/2}}$$



$$\sigma = \frac{q}{\pi R^2}, \quad dq = \sigma\, d\Sigma$$

$$dq = \sigma\, d\Sigma = \underbrace{\frac{q}{\pi R^2}}_{\sigma}\,\underbrace{2\pi r\, dr}_{d\Sigma} \Rightarrow$$

$$dE_x = \frac{\sigma\, \cancel{2}\cancel{\pi}\, r\, dr}{2\cancel{4}\cancel{\pi}\varepsilon_0}\,\frac{x}{(x^2+r^2)^{3/2}}$$

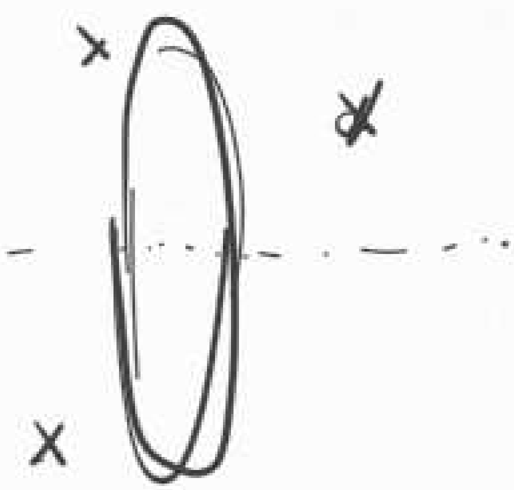
$$E_x = \int_0^R \frac{\sigma x}{2\varepsilon_0}\,\frac{r\,dr}{(x^2+r^2)^{3/2}} = \frac{\sigma x}{2\varepsilon_0}\left(-\frac{1}{\sqrt{r^2+x^2}}\right)\Bigg|_0^R =$$

$$= \frac{\sigma x}{2\varepsilon_0}\left(\frac{1}{x} - \frac{1}{\sqrt{x^2+R^2}}\right) = \boxed{\frac{\sigma}{2\varepsilon_0}\left(1 - \frac{x}{\sqrt{x^2+R^2}}\right)} \Rightarrow$$

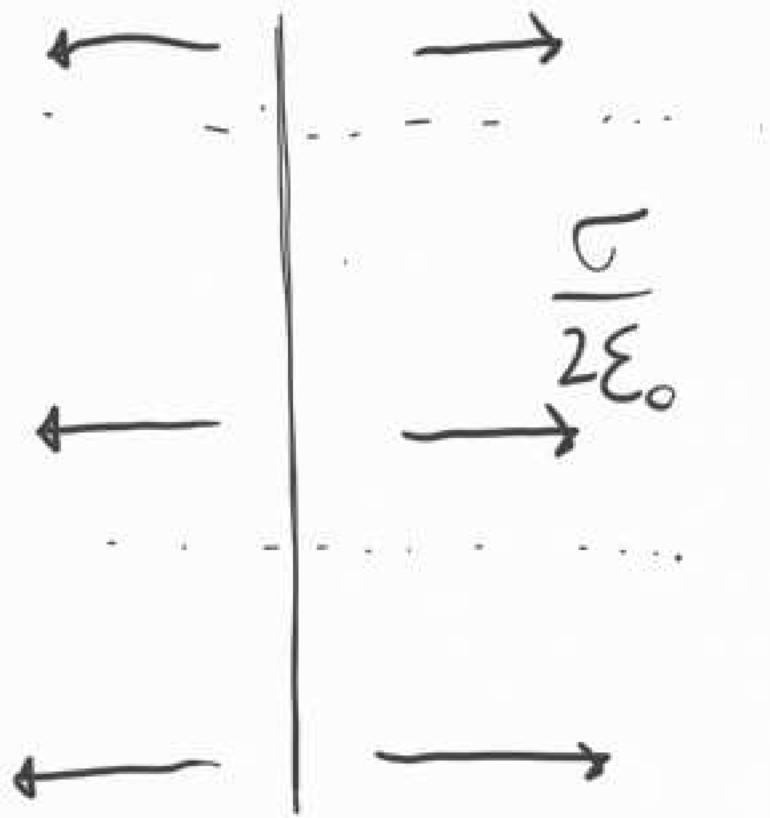
2) $E_x \xrightarrow[R \to \infty]{} ?$

$$\frac{\sigma}{2\varepsilon_0}\left(1-\frac{x}{\sqrt{R^2+x^2}}\right) \xrightarrow[R \to \infty]{} \boxed{\frac{\sigma}{2\varepsilon_0}}$$

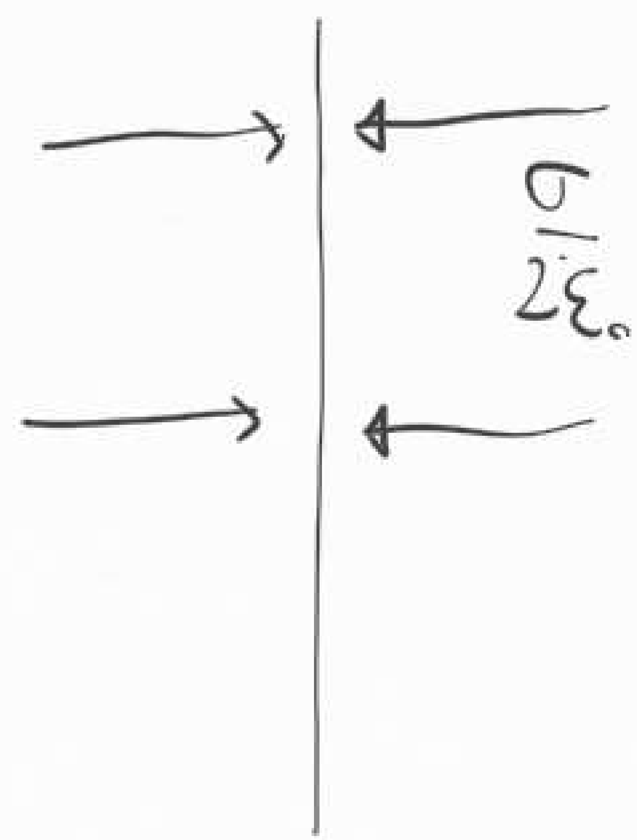
$\bar{E}$



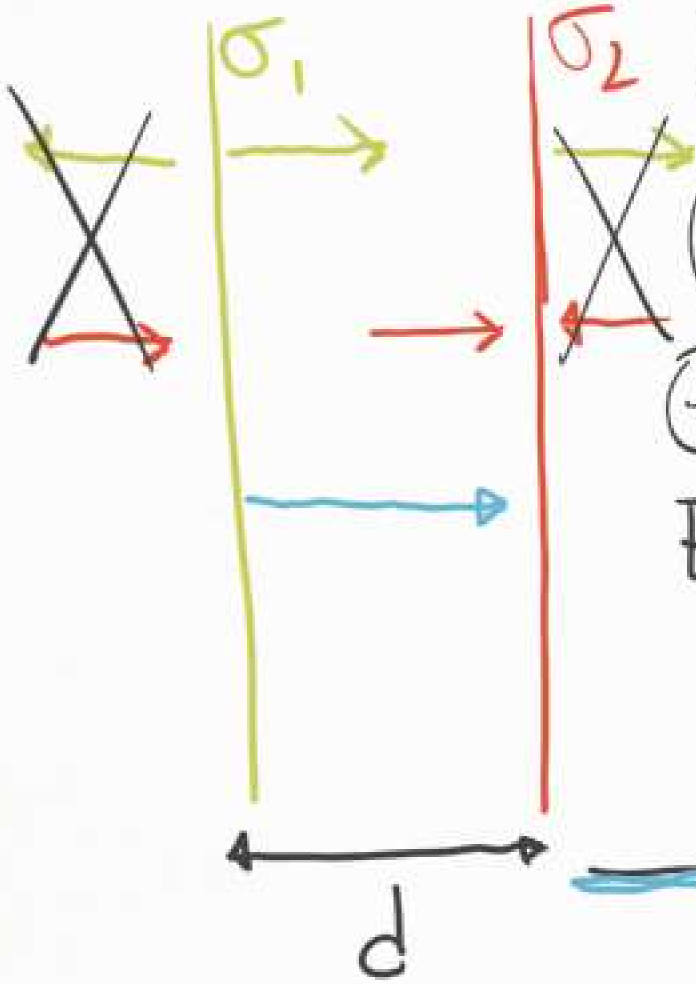
$\sigma > 0$



$\sigma < 0$



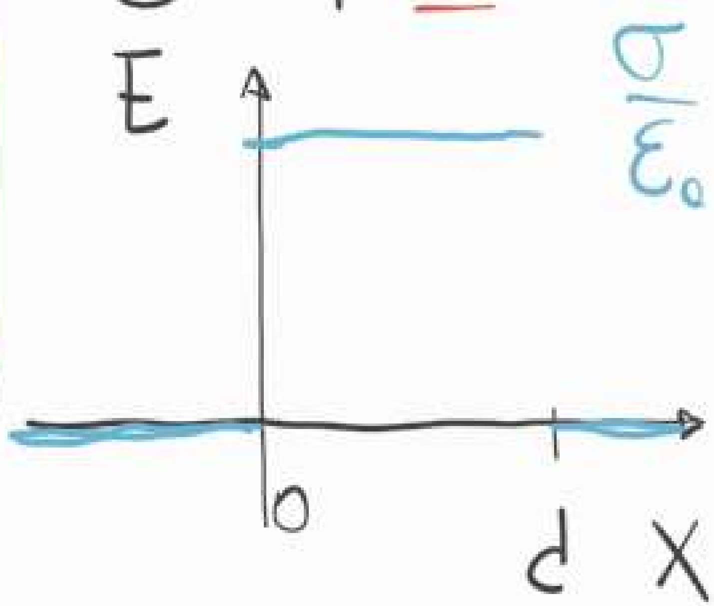
$\bar{E}(x) = ?, \quad V(x) = ?$



(1) $\sigma_1 = -\sigma_2$

(2) $\sigma_1 = \sigma_2$

(1) $\sigma_1 = \underline{\sigma} > 0, \quad \sigma_2 = -\underline{\sigma} < 0$



$$\Delta V_{AB} = -\int_A^B \vec{E} \cdot d\vec{s} =$$

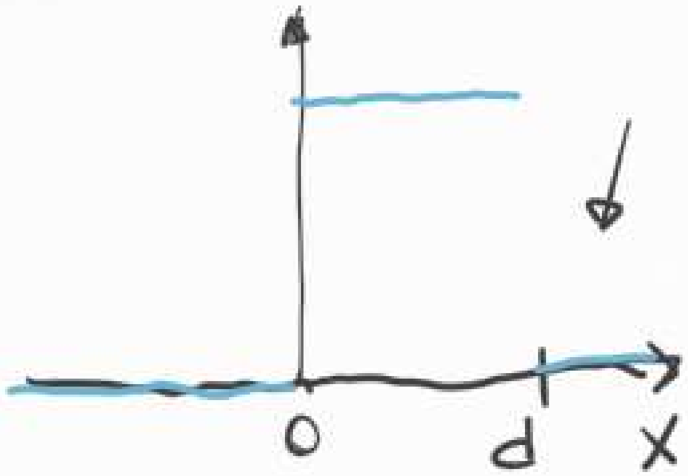
$$= V(B) - V(A)$$

↑

FUNZIONE POTENZIALE

$$\Delta V = V(x) - V(A) \Rightarrow$$

$$\boxed{V(x) = \Delta V + V(A)}$$

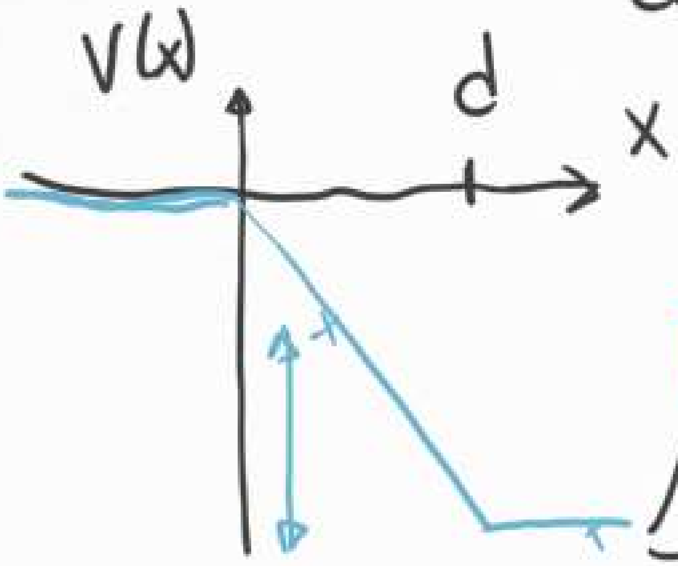


$$\Delta V_{0x} = -\int_0^{|x|} \vec{E} \cdot d\vec{s} \quad \begin{cases} x < 0 \\ 0 \leq x \leq d \\ x > d \end{cases}$$

$\boxed{0 \leq x \leq d}$

$$\Delta V_{0x} = -\int_0^{|x|} E\,dx = -\int_0^{|x|} \frac{\sigma}{\varepsilon_0}\,dx = -\frac{\sigma x}{\varepsilon_0} = V(x) - V(0)$$

$$\Rightarrow V(x) = -\frac{\sigma}{\varepsilon_0} x + V(0) \longrightarrow V(x) = -\frac{\sigma}{\varepsilon_0} x$$

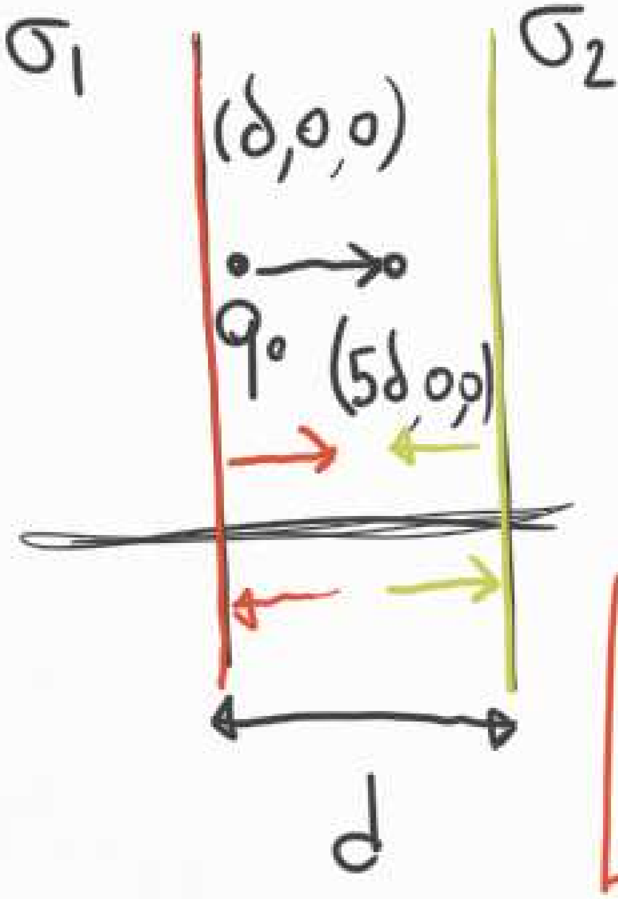


$\boxed{x < 0}$

$$\Delta V_{0x} = 0 = V(x) - V(0) = V(x)$$

$\boxed{x > d}$

$$\Delta V = -\int_0^x E\,dx = -\int_0^d E\,dx + \cancel{\int_d^x E\,dx} = -\frac{\sigma}{\varepsilon_0} d$$



$$W = ?$$

$$W = \int_A^B \vec{F}\cdot d\vec{s} = -q_0\,\Delta V = -\Delta U_e$$

$$\boxed{\vec{E}_1 = \frac{\sigma_1}{2\varepsilon_0}\hat{x}\ , \quad \vec{E}_2 = -\frac{\sigma_2}{\varepsilon_0}\hat{x}}$$

$$\vec{E} = \frac{\sigma_1-\sigma_2}{2\varepsilon_0}\hat{x} \Rightarrow \vec{F} = q_0\vec{E} = \frac{q_0(\sigma_1-\sigma_2)}{2\varepsilon_0}\hat{x}$$

$$\int \vec{F}\cdot d\vec{s} = \int_{\delta}^{5\delta} F\,dx = \frac{q_0(\sigma_1-\sigma_2)}{2\varepsilon_0}4\delta$$

② $\sigma_1 = -\sigma_2 > 0$, A $t=0$ $q_0 > 0$ SI TROVA IN

IN $(\delta, 0, 0)$ CON $\vec{v} = (v_{0x}, v_{0y}, v_{0z})$

SCRIVERE L'ESPRESSIONE DI t^*, DOVE t^* È IL TEMPO IN CUI q_0 URTA σ_2, CIOÈ QUANDO q_0 HA $x = d$

$\vec{E} = ?$

① $V(x,y,z) = A(xz - 2z^2)$

② $V(x,y,z) = A(\cos(kx) + Bz - \log y)$

$$\int_A^B \vec{E}\cdot d\vec{l} = V(A) - V(B) = -\left(V(B) - V(A)\right)$$

$$\boxed{\int_0^x f(x')\,dx' = F(x')\Big|_0^x = F(x) - F(0)} = G(0) - G(x)$$

$$G(x) = -F(x)$$

$$\vec{E} = -\vec{\nabla} V$$

$$\boxed{\frac{dF}{dx} = f}, \quad \frac{dH}{dx} = f$$

$$H(x) = F(x) + C$$