$$L(\vec{x}, \dot{\vec{x}}) = -mc^2 \sqrt{1 - \frac{\dot{\vec{x}}^2}{c^2}}$$

константа

a)

$$p_x = \frac{\partial L}{\partial \dot{x}} = -mc^2 \frac{1/2}{\sqrt{1 - \frac{\dot{x}^2}{c^2}}} \left(- \frac{2\dot{\vec{x}}}{c^2} \right) =$$

$$= + \frac{m\cancel{c^2}\dot{\vec{x}}}{\cancel{c^2}\sqrt{1 - \frac{\dot{x}^2}{c^2}}}$$

$$= \frac{m\dot{\vec{x}}}{\sqrt{1 - \frac{\dot{x}^2}{c^2}}} \Rightarrow \sqrt{1 - \frac{\dot{x}}{c^2}} = \frac{m\dot{x}}{p_x}$$

$$H = p_x \dot{\vec{x}} + L = \frac{m\dot{\vec{x}}}{\sqrt{1 - \frac{\dot{x}^2}{c^2}}} \dot{\vec{x}} + mc^2 \sqrt{1 - \frac{\dot{x}^2}{c^2}} \Bigg|_{\dot{\vec{x}} = \sqrt{\frac{p_x^2 c^2}{m^2c^2 + p_x^2}}}$$

$$p_x \sqrt{1 - \frac{\dot{x}^2}{c^2}} = m\dot{x}$$

$$\dot{x} = \sqrt{\frac{p_x^2 c^2}{m^2c^2 + p_x^2}}$$

$$H = \frac{m}{\sqrt{1 - \frac{p_x^2}{m^2c^2 + p_x^2}}} \cdot \frac{p_x^2 c^2}{m^2c^2 + p_x^2} + mc^2 \sqrt{1 - \frac{p_x^2}{m^2c^2 + p_x^2}} =$$

$$\boxed{H = \frac{p_x^2 c}{\sqrt{m^2c^2 + p_x^2}} + \frac{m^2c^2}{\cancel{p_x}} \cdot \frac{\cancel{p_x} c}{\sqrt{m^2c^2 + p_x^2}} = \frac{p_x^2 c + m^2 c^3}{\sqrt{m^2c^2 + p_x^2}}}$$

б)

18:15

$$\boxed{\dot{p}_x = -\frac{\partial H}{\partial x} = 0}$$

$$\dot{x} = \frac{\partial H}{\partial p_x} = \frac{(2p_x c)\sqrt{m^2c^2+p_x^2} - \frac{1}{2}\frac{2p_x}{\sqrt{m^2c^2+p_x^2}}(p_x^2c+m^2c^3)}{m^2c^2+p_x^2}$$

$$= \frac{2p_xc(m^2c^2+p_x^2) - p_x(p_x^2c+m^2c^3)}{(m^2c^2+p_x^2)^{3/2}}$$

в)