Consider equation (2.7) for the classical path.

$$\frac{d}{dt}\frac{\partial L}{\partial \dot{x}} - \frac{\partial L}{\partial x} = 0 \tag{2.7}$$

Substitute (2.7) into (2.6) to obtain

$$\delta S_{cl} = \left(\delta x(t)\frac{\partial L}{\partial \dot{x}}\right)_{t_a}^{t_b} = \delta x_b \left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_b} - \delta x_a \left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_a} \tag{1}$$

For endpoints a and b we have $\delta S_{cl} = 0$ by equation (2.3).

$$\delta x_a = \delta x_b = 0 \tag{2.3}$$

However, suppose endpoint b is changed so that $\delta x_b \neq 0$. Then by (1)

$$\delta S_{cl} = \delta x_b \left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_b}$$

It follows that

$$\frac{\delta S_{cl}}{\delta x_b} = \left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_b}$$

and in the limit

$$\lim_{\delta \to 0} \frac{\delta S_{cl}}{\delta x_b} = \frac{\partial S_{cl}}{\partial x_b} = \left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_b}$$

Likewise, a change of endpoint a yields

$$\lim_{\delta \to 0} \frac{\delta S_{cl}}{\delta x_a} = \frac{\partial S_{cl}}{\partial x_a} = -\left(\frac{\partial L}{\partial \dot{x}}\right)_{x=x_a}$$