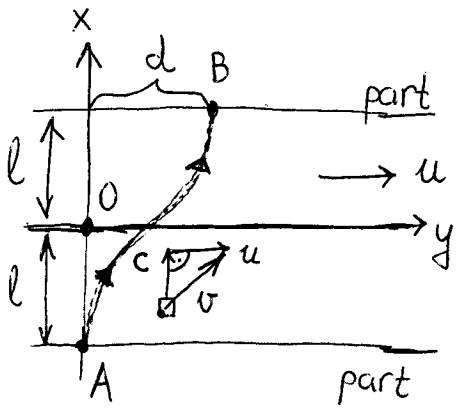
11.)



$v_x = c \qquad v_y = u$

$u = u_0\left(1 - \frac{x^2}{\ell^2}\right)$

(i) $y(x)$ (ii) $d = ?$

$$\boxed{\frac{dx}{dt} = v_x}$$

$$\boxed{x = x_0 + \int_0^t v_x\, dt}$$

(i) $x = -\ell + v_x t = -\ell + ct$

$$y = \int_0^t v_y\, dt = \int_0^t u_0\left(1 - \frac{x^2}{\ell^2}\right) dt \qquad \frac{dx}{dt} = c \rightarrow dt = \frac{dx}{c}$$

$$y = \frac{u_0}{c}\int_{-\ell}^{x}\left(1 - \frac{x^2}{\ell^2}\right) dx = \frac{u_0}{c}\left[x - \frac{x^3}{3\ell^2}\right]_{-\ell}^{x} =$$

$$= \frac{u_0}{c}\left(x - \frac{x^3}{3\ell^2} + \ell - \frac{\ell^3}{3\ell^2}\right) \rightarrow \underline{\underline{y(x)}}$$

(ii)

$$d = y(x=\ell) = \frac{u_0}{c}\left(\ell - \frac{\ell^3}{3\ell^2}\right) + \frac{2u_0\ell}{3c} \rightarrow \underline{\underline{d}}$$