NAME
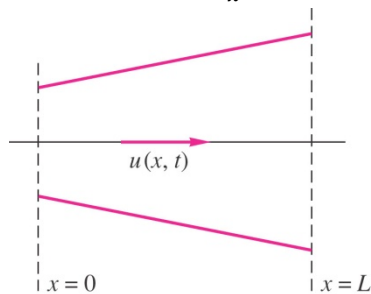
Fluids-ID

Quiz 5. When a valve is opened, fluid flows in the expansion duct shown below according to the approx-imation

$$\underline{V} = u\hat{\imath} = U\left(1 - \frac{x}{2L}\right)\left(\frac{Ut}{L}\right)\hat{\imath}$$

for t ≪ L/U. If L = 1 m and U = 1 m/s, then at $(x, t) = (L, L/2U)$,

1) Find the unsteady (local) acceleration of a_x
2) Find the convective acceleration of a_x
3) Find the total acceleration a_x

$u(x, t)$

$x = 0$ $x = L$

Acceleration:

$$a_x = \frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z}$$

$$a_y = \frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} + w\frac{\partial v}{\partial z}$$

$$a_z = \frac{\partial w}{\partial t} + u\frac{\partial w}{\partial x} + v\frac{\partial w}{\partial y} + w\frac{\partial w}{\partial z}$$