(EXAMPLE) [B-1-2]

Starting from the differential form of the x-momentum equation:
$$\frac{\partial(\rho u)}{\partial t} + \nabla \cdot \left(\rho u \vec{V}\right) = -\frac{\partial p}{\partial x} + \rho f_x + (f_x)_{\text{viscous}}$$
Derive the substantial derivative form of the x-momentum equation:
$$\rho \frac{Du}{Dt} = -\frac{\partial p}{\partial x} + \rho f_x + (f_x)_{\text{viscous}}$$