1) Show that divergence of vorticity is zero.
   Vorticity w_i and its divergence is given as follows in tensor notation

$$\boldsymbol{w_i = \varepsilon_{ijk}\frac{\partial u_k}{\partial x_j}}, \qquad \boldsymbol{\frac{\partial w_i}{\partial x_i} = 0}$$

2) Write the following identity in tensor notation and prove it

$$\boldsymbol{(\vec{V}\cdot\vec{\nabla})\vec{V} = \nabla\left(\frac{V^2}{2}\right) - \vec{V}\times\vec{\nabla}\times\vec{V}}$$

   Hint: use the identity $\boldsymbol{\varepsilon_{ijk}\varepsilon_{ilm} = \delta_{jl}\delta_{km} - \delta_{jm}\delta_{kl}}$

3) Use the following form of the momentum equation to derive an equation for kinetic energy per volume: $\boldsymbol{\kappa = \rho u_i u_i/2}$

$$\boldsymbol{\rho\frac{Du_i}{Dt} = -\frac{\partial p}{\partial x_i} + \frac{\partial \tau_{ji}}{\partial x_j}}$$

   Result should be in the following form

$$\boldsymbol{\frac{\partial \kappa}{\partial t} + \frac{\partial(u_i\kappa)}{\partial x_i}} = ?$$