

mid-term exam

2016.11.17

1. assume some 2-dimensional flow field satisfy

$$u = x + t$$

$$v = -y + t$$

determine the streamline and pathline that is through point $(-1, -1)$, when $t = 0$.

2. assume some 2-dimensional flow field satisfy

$$u = x + t$$

$$v = y + t$$

and let $x = a, y = b$ when $t = 0$, find the Lagrangian velocity expression.

3. assume some flow in a tube is steady, the cross-section area, density, and velocity is $A(x), \rho(x), u(x)$ respectively, deduct the mass conservation equation.
4. show mass conservation of incompressible flow is

$$\nabla \cdot \mathbf{u} = 0 \tag{1}$$