

## 0.1 Tutorial Week 1: Continuity Equation

### 0.1.1 Exercise 2

The system is steady due to the fact that our velocity field has no terms in  $t$ , meaning that our flow does not change with time - steady flow.

The fluid is compressible

$$v = 4 \ln y - 2y + 10 \quad (1)$$

$$\text{Volume dilatation} \rightarrow \frac{\partial v}{\partial y} = \frac{4}{y} - 2 \quad (2)$$

$$\text{Variation in the Volume dilatation} \rightarrow \frac{\partial^2 v}{\partial y^2} = -\frac{4}{y^2} \quad (3)$$

For the range  $1 < y < 4$ , the variation in the volume dilatation is negative, hence our fluid is compressible.

$$(0, 1) \rightarrow \frac{4}{1} - 2 = 2 \text{ s}^{-1} \quad (4)$$

$$(0, 3) \rightarrow \frac{4}{3} - 2 = -\frac{2}{3} \text{ s}^{-1} \quad (5)$$