

Name: Class: TLU ID #:

Chapter 4

Fluid Kinematics

Homework Assignment No. 4

Due on Monday, April 8, 2024

Students do the following problems from your textbook: 4.5; 4.10; 4.53; 4.55;

Please also solve the following problems:

1. A flow field is defined by $u = 2y$ and $v = xy$. Derive expressions for the x and y components of acceleration. Find the magnitude of the velocity and acceleration at point M ($x=2$; $y=3$). Specify units in terms of L and T . Determine the equation of the streamline that passes through the point M. On a graph, plot this streamline.
2. A flow field is defined by $u = 3y$, $v = 2xy$, and $w = 5z$. Derive expressions for the x , y , and z components of acceleration. Find the magnitude of the velocity and acceleration at point N (1; 2; 1). Specify units in terms of L and T .
3. A flow is modeled by the steady, two-dimensional velocity field given by $\vec{V} = (a + bx)\vec{i} - by\vec{j}$.

$$\text{The pressure is given by } p = p_0 - \frac{\rho}{2} [2abx + b^2(x^2 + y^2)]$$

where: p_0 is the pressure at $x = 0$. Generate an expression for the rate of change of pressure following a *fluid particle*.

4. A flow field is defined by $u = 7 + 4x$ and $v = -11 - 4y$. Determine the equation of the streamline that passes through the point N ($x=2$; $y=1$).