Name: …… Class: ……... TLU ID #: ……....

Chapter 4

Fluid Kinematics

Homework Assignment No. 5

Due on Monday, March 18, 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 $\vec{V} = (a + bx)\vec{i} - by\vec{j}$.

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

   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). On a graph, plot this streamline, with arrows.