Problem Set (2)

1- The velocity field of a flow is given by, $\vec{V} = (3y + 2)\,\hat{i} + (x - 8)\,\hat{j} + 5z\hat{k}$ m/s, where x, y and z are in m. Determine the fluid velocity at the origin (0, 0, 0) and on the y axis (x = z = 0).

2- The velocity field of flow Is given by $\vec{V} = 2x^2 t\,\hat{i} + \left[4y(t-1) + 2x^2 t\right]\hat{j}$ m/s, where x and y are in m, and t is in seconds. For the fluid particles on the x-axis, determine the velocity and direction of flow.

3- The velocity field of a flow is given by, $\vec{V} = \frac{10y}{\sqrt{x^2 + y^2}}\,\hat{i} - \frac{10x}{\sqrt{x^2 + y^2}}\,\hat{j}$ m/s, where x and y in m. Determine the fluid velocity at points along the x-axis and y-axis. What is the angle between the velocity vector and x-axis at the point (x, y) = (5, 0), (5, 5) and (0, 5)?

4- The x and y-components of a velocity field are given by:
$U = x - y$ and $v = x^2 y - 8$. Determine the location of any stagnation points in the flow field. That is, at what point(s) is the velocity zero.

5- A two-dimensional velocity field is described in terms of Cartesian components. $u = 2xy^2$, $v = 2x^2 y$. Write the equation of the streamline passing through the point (1, 7).

6- A three-dimensional velocity field is given by $u = 2x$, $v = -y$ and w = z. Determine the acceleration vector.

7- A fluid velocity field is given by $u = cx^2$ and $u = cy^2$, where c is a constant. Determine the x and y-component of the fluid acceleration. At what point(s) in the flow field the acceleration is zero?

8- Water flows through a constant diameter pipe with uniform velocity given by $\vec{V} = \left[(8/t) + 5\right]\hat{j}$ m/s where t is in s. Determine the acceleration at time t = 1, 2 and 10s.

9- Find the resultant acceleration of a fluid particle as it moves through the point (1, 2) in the steady two-dimensional field described by, $\|\vec{V}\| = \sqrt{5y^2 + x^2 + 4xy}$ m/s with $xy + y^2 = k$ (stream lines).

10- Find the resultant acceleration of a fluid particle whose motion is described by, $\|\vec{V}\| = \omega r$ m/s with $x^2 + y^2 = k$ (stream lines).