

Homework Set #2Assignment #1:

Open up your favorite web browser and go to <http://web.mit.edu/fluids/www/Shapiro/ncfmf.html> Watch the 38-minute video titled "Deformation of Continuous Media" and answer the following questions:

- a) Name four important characteristics of the principal axes.
- b) What does vorticity measure?

Assignment #2:

(Adapted from R. M. Olson and S. J. Wright, *Essentials of Engineering Fluid Mechanics*, 5th edition, Harper & Row, New York, 1990)

Determine if the following velocity fields describe an irrotational fluid flow. Clearly show your logic.

- a) $V_x = x^2 \cos(y)$, $V_y = -2xy \sin(y)$
- b) $V_x = x + 2$, $V_y = 1 - y$
- c) $V_x = xyt$, $V_y = x^3 - \frac{y^2 t}{2}$
- d) $V_x = \ln(x) + y$, $V_y = xy - \frac{y}{x}$
- e) $V_x = x + y$, $V_y = x - y$

Assignment #3:

The following functions of x and y have been suggested as possible stream functions for a steady, incompressible flow.

- a) $\psi_1 = x^2 + 2y$
- b) $\psi_2 = 5xy$

In each case,

- i. determine if the flow is rotational or irrotational.
- ii. sketch several streamlines (lines of constant ψ) in the x - y plane ($-5 < x < 5$, $0 < y < 5$). What steady physical flow would the flow field represent? (Recall that because there is no flow across a streamline, every streamline could represent a solid boundary.)