Homework Set #1

Problem 1

Open up your favorite web browser, go to http://web.mit.edu/fluids/www/Shapiro/ncfmf.html , and watch the 30-minute video titled "Flow Visualization" and answer the following questions:

(a) Define the following terms used in the video:

i. a timeline

ii. a pathline

iii. a streakline

iv: a streamline

(b) Name three different physical techniques that are used for flow visualization in the video.

Problem 2

Three different velocity fields are presented below:

(a) $V_x = x^2; \quad V_y = -y^2$

(b) $V_x = 2x + 2; \quad V_y = 1 - 2y$

(c) $V_x = 2y; \quad V_y = 3x - 3$

For each velocity field do the following:

(i) Determine if the velocity field describes the flow of an incompressible fluid.

(ii) If the flow describes an incompressible fluid flow, sketch the velocity field in an x-y plane by drawing four velocity arrows to scale on the x-y plane at points (x,y) = (0,0), (0,2), (2,2), and (2,0).