

Homework #0

Course: 414.311A

Due on
September 17, 2013

1. (30%) Describe the following terms:

- (1) ideal fluid
- (2) Newtonian flow
- (3) Vorticity
- (4) Velocity potential
- (5) Streamline, Streakline, pathline, timeline
- (6) Added mass

2. (20%) Write the velocity potential of the following singularity.

- (1) 2-D source and dipole
- (2) 3-D source and dipole

3. (20%) In a 3-D fluid domain, write the following equations. Use your own definition as needed.

- (1) Laplace equation
- (2) Bernoulli's equation
- (3) Navier-Stokes equation

4. (30%) Let's consider a 1-D vibration system consisted of a mass m and spring k .

- (1) Derive equation of motion.
- (2) What is the natural frequency of this system?

5. (20%) Let's consider a 2-D source near a vertical wall, as shown in the right figure. Its coordinate is $(x,y)=(-1,0)$.

- (1) Show that the wall boundary condition satisfies if one additional point source locates at $(1,0)$, $(1,-1)$.
- (2) Obtain velocity potential, velocity, and pressure at two locations:
i) $x=0$, $y=1$, ii) $x=-0.5$, $y=0.5$.

