MAE578, Spring 2017 Homework #4

This assignment will contribute to 10% of the total score for the course

1. Solve Problem 4 in Chapter 7 of the textbook. Make a plot of the structure of the pressure and velocity fields. Since the system is axially symmetric, you can just make line plots of the pressure and tangential velocity. Alternatively, you can make the 2-D plot of pressure and horizontal velocity by using contours to represent pressure and arrows (using the "quiver" function in Matlab) to represent velocity. (25%)

2. Solve Problem 6 in Chapter 7. Note that "southerly" means "northward". You do not need to answer the last question, "What vertical displacement would produce ... ?" (25%)

3. Solve Problem 9 in Chapter 7. Note that "westerly" means "eastward". Also, assume that the system is in the Northern Hemisphere (so the "winter pole" in Fig. 7.29 is North Pole.) (25%)

4. At 30°N, a river runs strictly from north to south with a uniform velocity of 10 cm/s. It is 1 km wide as illustrated in Fig. 1. Assume that the flow of the river is in geostrophic balance and ignore the effect of friction. Determine the difference in the depth of water across the river. You may assume that the density of water is $\rho = 1000$ kg/m^3. In your answer, please clearly indicate whether the depth of water increases eastward or westward.) (25%)

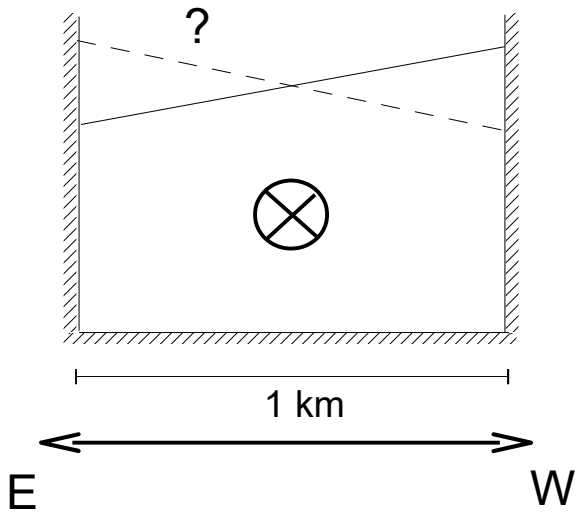

Fig. 1 *Schematic diagram for the setup of Prob 4. This is the cross-sectional view of the river from an observer facing south. (The river flows into the paper.)*