Name _____ CM _____

Instructor/Section (Circle one): Richards – 8 Richards – 9

Mayhew – 8 Richards – 9

ES202

Examination II

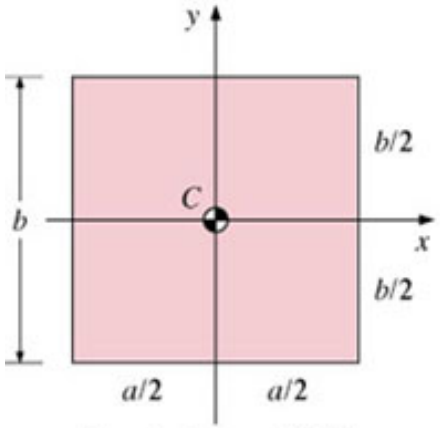
January 24, 2005

Problem	Points	Score
1	28	
2	36	
3	36	
Total	100	

Show all work for full credit.

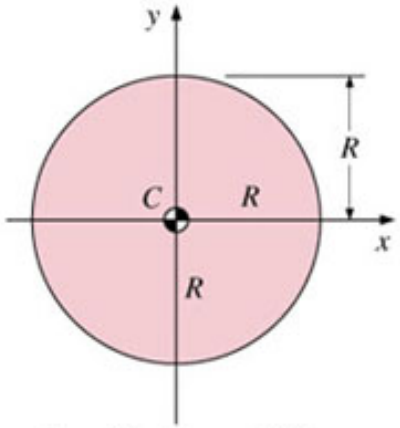
One equation/notes page allowed (1 side, 8-1/2 x 11 sheet).

Laptops allowed but no pre-prepared worksheets, etc.



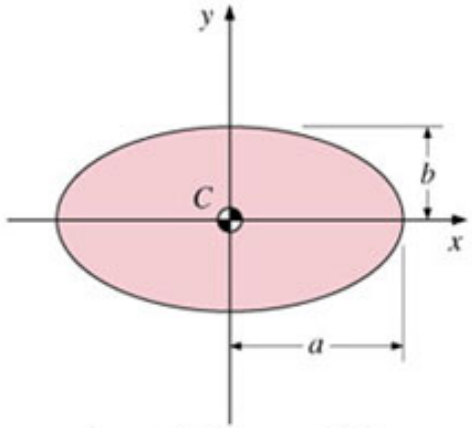
$A = ab,\ I_{xx,C} = ab^3/12$

(*a*) Rectangle



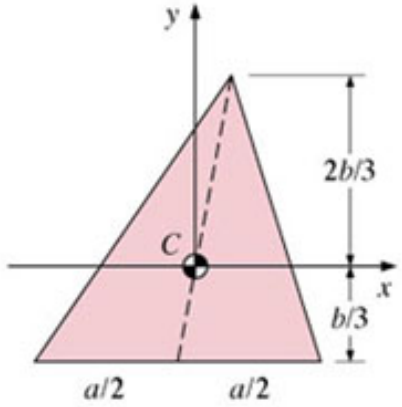
$A = \pi R^2,\ I_{xx,C} = \pi R^4/4$

(*b*) Circle



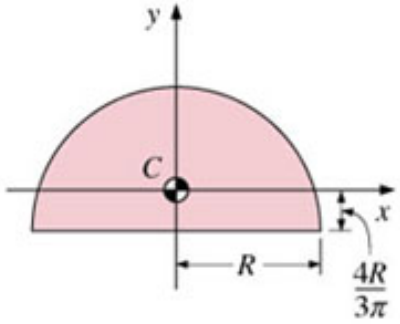
$A = \pi ab,\ I_{xx,C} = \pi ab^3/4$

(*c*) Ellipse



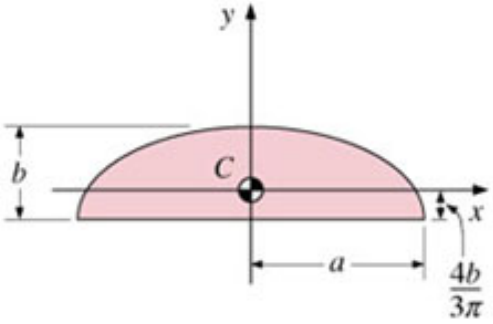
$A = ab/2,\ I_{xx,C} = ab^3/36$

(*d*) Triangle



$A = \pi R^2/2,\ I_{xx,C} = 0.109757R^4$

(*e*) Semicircle



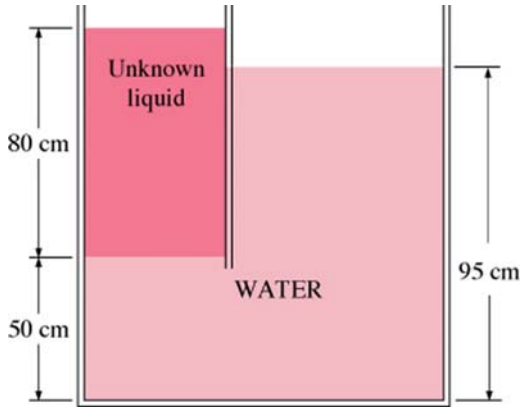
$A = \pi ab/2,\ I_{xx,C} = 0.109757ab^3$

(*f*) Semiellipse

Cengel & Turner, Fig 11-6 – will be provided on the exam

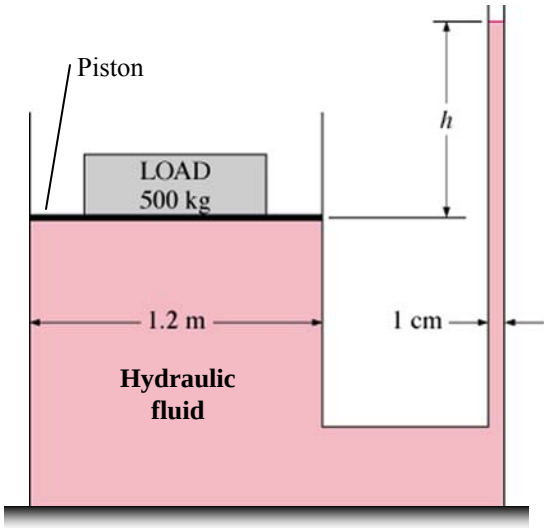
Problem 1 (28 points)

(a). (7 points) Find the specific gravity (SG) of the unknown liquid in the tank. The fluids do not mix, and the density of water is 1000 kg/m^3.



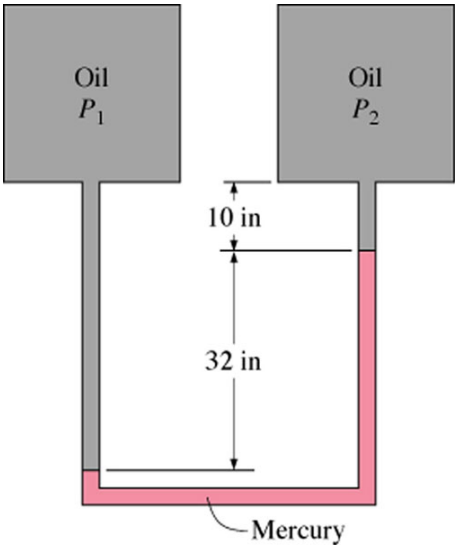
(b) (7 points) A hydraulic lift supports a load of 500 kg. The hydraulic lift piston is square, 1.2 m x 1.2 m, and has negligible friction and mass. The hydraulic fluid has a density of 780 kg/m^3.

Find the height *h* of the hydraulic fluid in the 1-cm column.



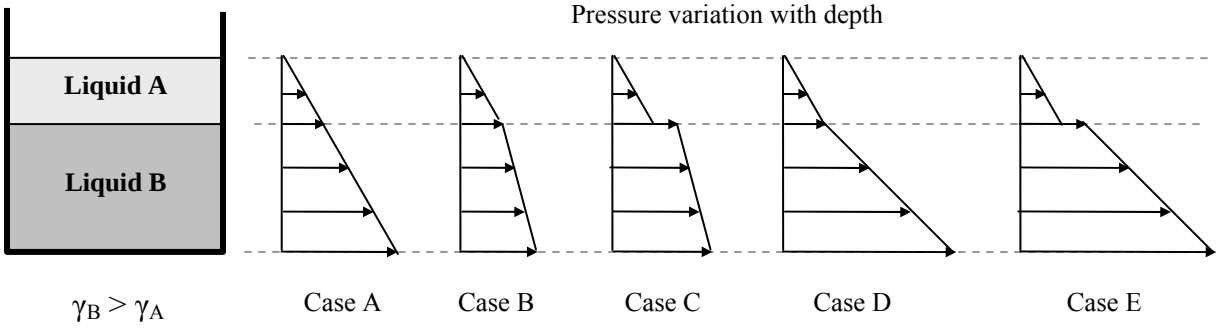
(c) (7 points) A mercury manometer measures the pressure difference between two oil reservoirs. The density of oil is 45 lbm/ft^3 and the density of mercury is 848 lbm/ft^3. The fluids do not mix.

Find the quantity P_2-P_1, in lbf/ft^2 or psi.



(d) (7 points) A tank contains two liquids arranged in layers as shown in the figure. The specific weight of fluid B is greater than the specific weight of fluid A, $\gamma_B > \gamma_A$.

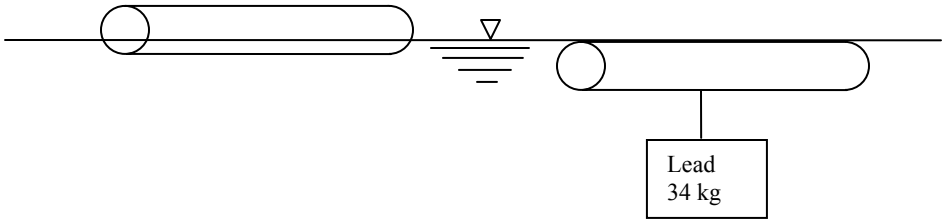
Circle the Case that best represents how pressure varies in the tank.



Problem 2 (36 points)

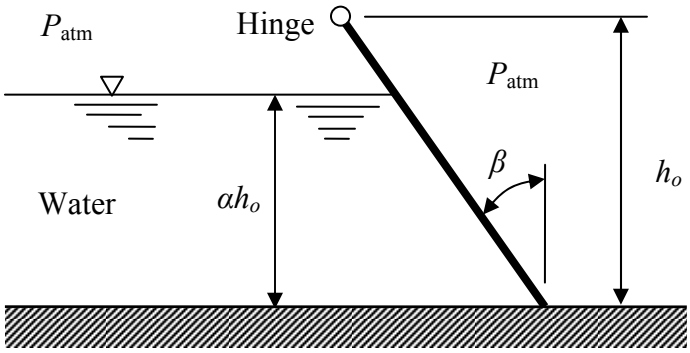
A log weighing 1540 N floats on a lake. When a 34-kg block of lead is tied to the log, it causes the log to submerge and float just below the surface. The specific gravity of lead is 11.3. The density of water is 1000 kg/m^3.

Find the density of the log.



Problem 3 (36 points)

A body of water is held in place by a hinged, rectangular gate as shown in the figure. The gate is uniform in thickness and density. It has a weight W and a uniform width L (normal to the page). The gate hinge has an elevation h_o. The gate is held closed solely due to its own weight and will open when water pressure acts to overcome the effect of the weight.



Determine an expression for W/L, the weight of the gate per unit width, that will cause the gate to open when the water level reaches a height αh_o where $0 \le \alpha \le 1.0$.

Your answer should be in terms of *some* or *all* of the following variables: ρ_{water}, g, γ_{water}, α, h_o, β, and L.