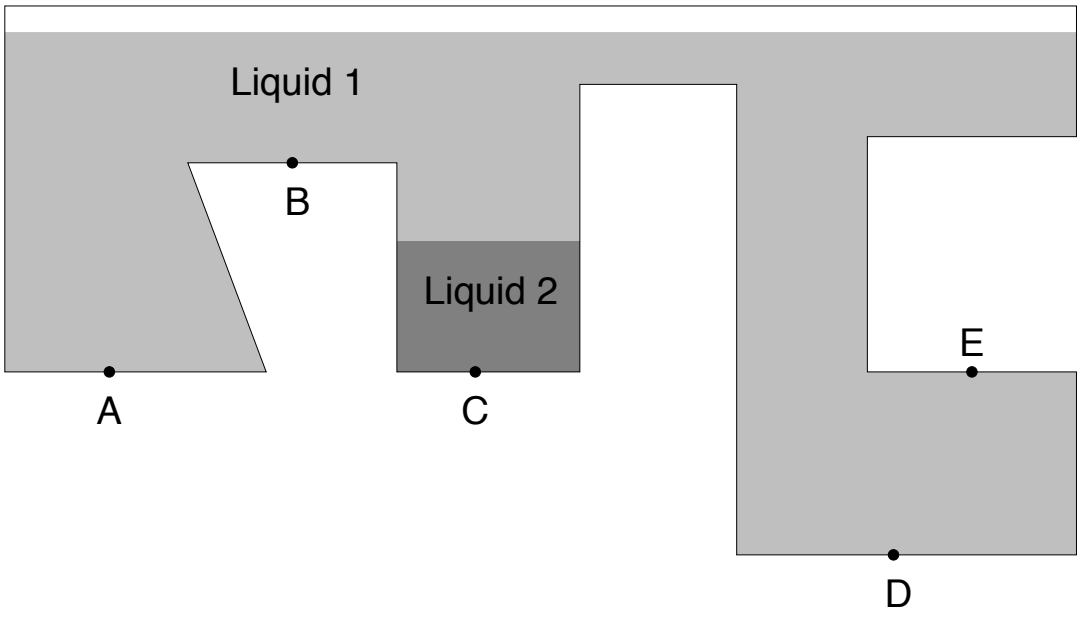
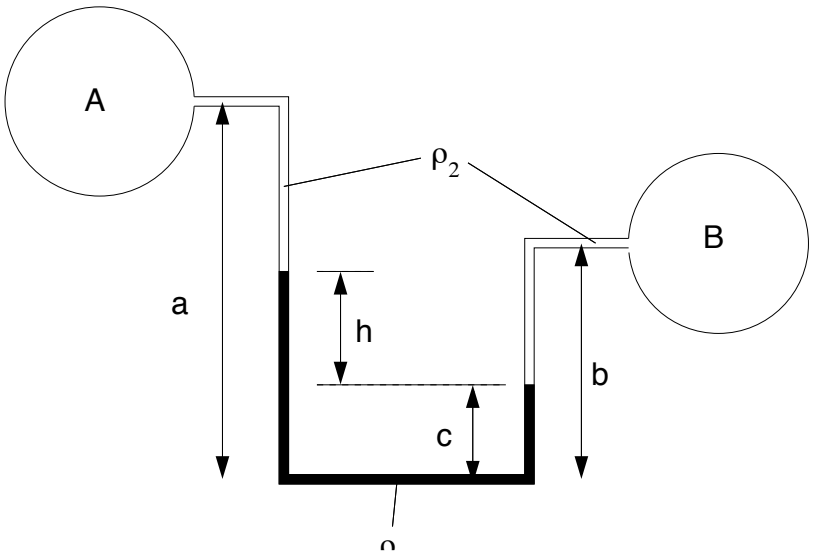
1. (5 marks) The tank in the sketch contains two liquids, as shown. Order the points from highest to lowest pressure. You can give your answer as a single ordering, as in: "$X > Y > Z$" or, in cases of ambiguity, as two or more partial orderings: "$X > Y$ and $X > Z$", indicating that you can't tell which of Y and Z has higher pressure.



2. (5 marks) Pipes A and B in the sketch are carrying fluid in the direction perpendicular to the page. Use the manometer shown to find the pressure difference $P_B - P_A$. You may leave your answer in symbolic form if you wish. If you prefer to work with numbers, use:

$$\rho_1 = 1000^{\text{kg}}/_{\text{m}^3} \qquad \rho_2 = 800^{\text{kg}}/_{\text{m}^3}$$

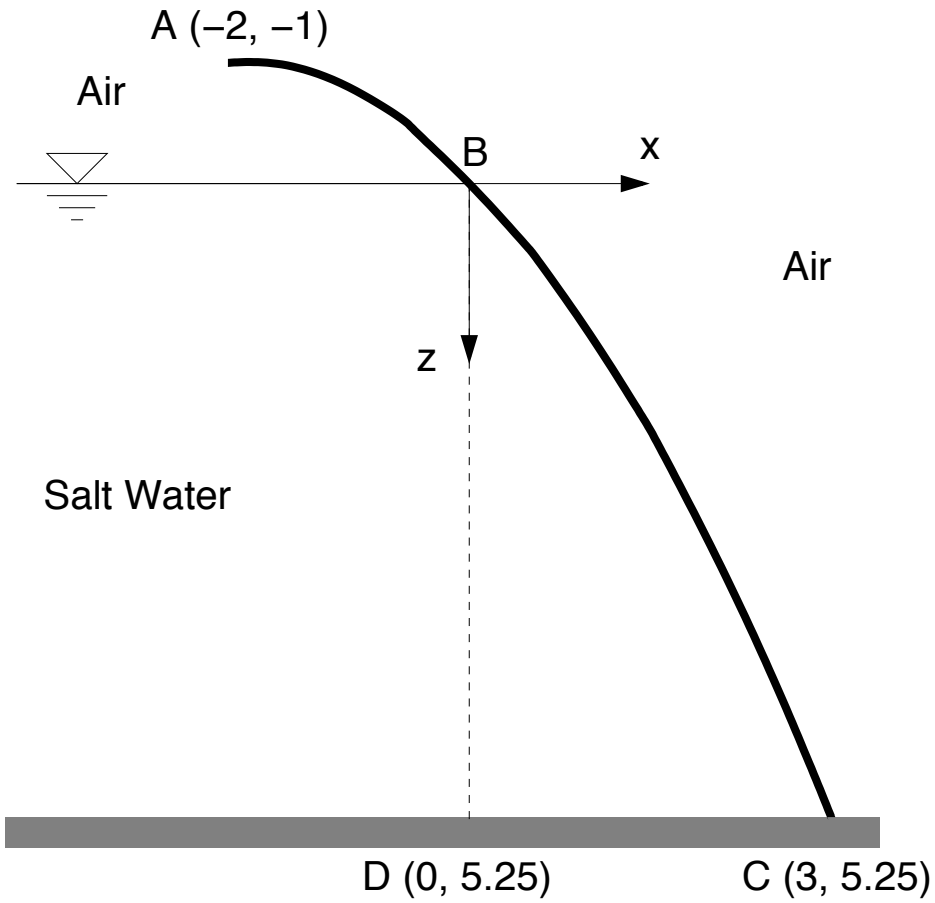
$$a = 0.8\text{m} \qquad b = 0.65\text{m} \qquad c = 0.2\text{m} \qquad h = 0.3\text{m}$$



3. (30 marks) An aquarium has a tropical reef display whose front is curved, as shown in the sketch. The tank is 5 m wide in the direction perpendicular to the page, and the shape of the curved wall can be written as:

$$z = \frac{(x+2)^2}{4} - 1$$

using the coordinate system in the sketch. All distances, including the coordinates labeled on the sketch, are in meters. The density of salt water is $1030\,{}^{\mathrm{kg}}/_{\mathrm{m}^3}$.



(a) (5 marks) Sketch the pressure distribution along the side of the tank ABC.

(b) (5 marks) Write the weight of the water under the curved tank wall (that is, the water in the region BCD in the sketch) as a double integral with the appropriate domain, and evaluate this integral.

(c) (5 marks) Repeat this process to find the x-location of the center of mass of the water in region BCD.

(d) (7 marks) Find the net pressure force on the side of the tank ABC; write this in terms of its horizontal and vertical components, with the direction clearly indicated for each.

(e) (8 marks) Find the moment that the pressure force exerts about the base of the curved side C. You may neglect the weight of the tank wall.