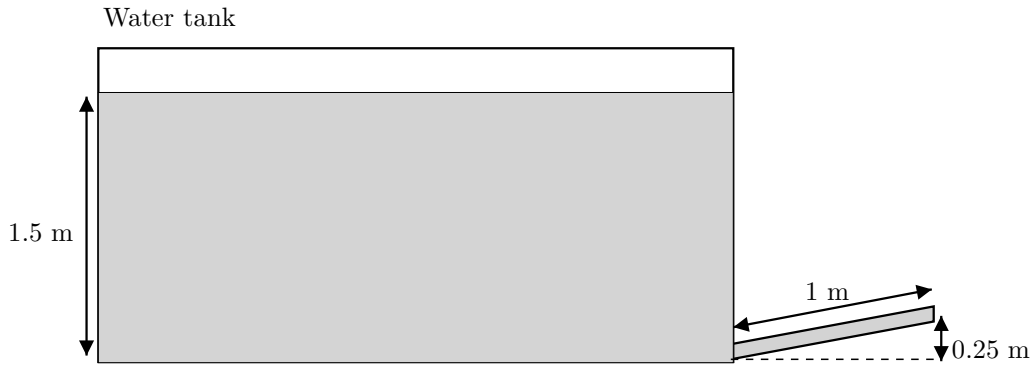
1. Tank drainage through a rising tube

   A large tank of water 1.5 meters deep drains through a tube from the bottom/side 1 m long and 0.1 m in diameter, which rises 0.25 m from the bottom, as shown below.




   (a) Calculate the velocities and pressures just inside the two ends of the tube where the water is flowing out. (Atmospheric pressure is 101300 $\frac{\text{N}}{\text{m}^2}$.)

   (b) Calculate the thickness of the boundary layer at the exit of the tube using the laminar and turbulent flow expressions. Is the Bernoulli equation likely to be accurate?

   (c) Using the laminar flow boundary layer expression, calculate the shear stress on the tube wall 10 cm from its entrance.