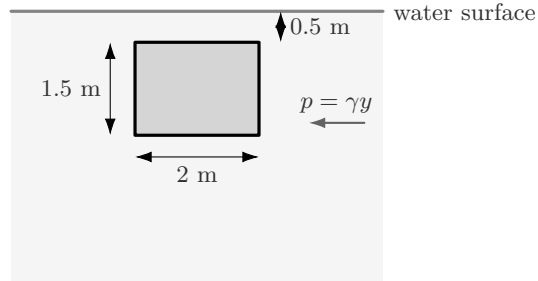
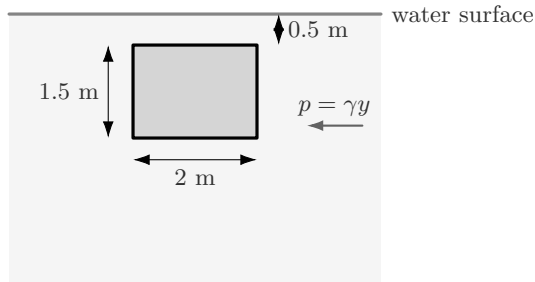


Question 1

A vertical aquarium window is (2) m wide and (1.5) m high; its top is (0.5) m below freshwater. Find the force ($\gamma = 9800 \text{ N/m}^3$).



Question 1 – Solution



Step 1: Choose the depth variable. Let y be the depth below the water surface, measured in meters. The window extends from

$$y = 0.5 \quad \text{to} \quad y = 0.5 + 1.5 = 2.$$

Step 2: Write the pressure at depth y . Freshwater has weight density $\gamma = 9800 \text{ N/m}^3$, so

$$p(y) = \gamma y = 9800y \quad \text{N/m}^2.$$

Step 3: Find the area of a horizontal strip. The window is 2 m wide. A strip of thickness dy has area

$$dA = 2 \, dy.$$

Therefore,

$$dF = p(y) \, dA = (9800y)(2 \, dy).$$

Step 4: Integrate over the window.

$$\begin{aligned} F &= 9800 \int_{0.5}^2 2y \, dy = 9800 [y^2]_{0.5}^2 \\ &= 9800(4 - 0.25) = 9800(3.75) = 36,750 \text{ N}. \end{aligned}$$

$$\boxed{F = 36,750 \text{ N}}$$