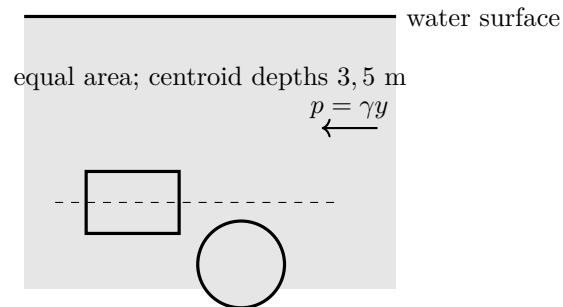
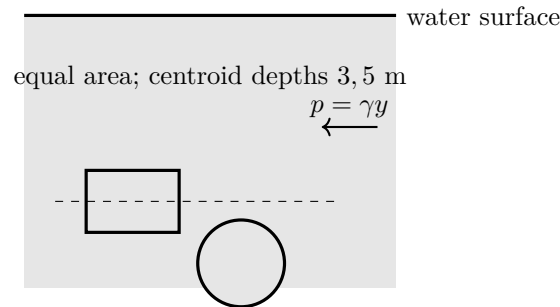


Question 5

Two equal-area vertical plates are fully submerged in the same liquid of constant weight density, with centroid depths 3 m and 5 m. Compare their hydrostatic forces without knowing their shapes.



Question 5 – Solution



Step 1: Use the centroid formula. For any vertical plane region submerged in a liquid of constant weight density,

$$F = \gamma A \bar{y}.$$

Step 2: Write the force on each plate. Let the common area be A . If Plate 1 has centroid depth 3 m and Plate 2 has centroid depth 5 m, then

$$F_1 = \gamma A(3), \quad F_2 = \gamma A(5).$$

Step 3: Compare the forces.

$$\frac{F_2}{F_1} = \frac{\gamma A(5)}{\gamma A(3)} = \frac{5}{3}.$$

The shape does not affect this comparison because both plates have the same area; only the centroid depth differs.

$$F_2 = \frac{5}{3} F_1$$

Thus the deeper plate experiences $66\frac{2}{3}\%$ more force.