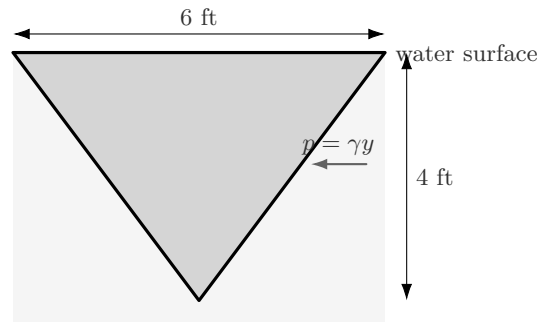
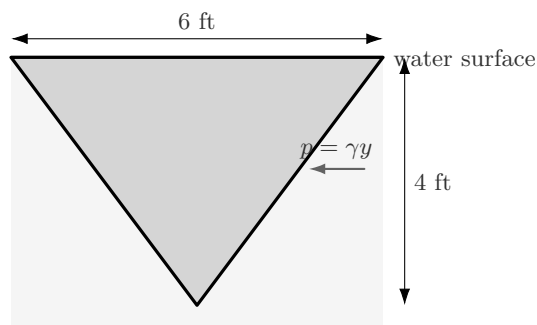


Question 2

An inverted triangular gate has top width (6) ft at the surface and vertex (4) ft deep. Find the force ($\gamma = 62.4 \text{ lb/ft}^3$).



Question 2 – Solution



Step 1: Choose the depth variable. Let y be depth below the water surface. The gate extends from $y = 0$ to $y = 4$ ft.

Step 2: Find the width of the gate at depth y . The width decreases linearly from 6 ft at $y = 0$ to 0 ft at $y = 4$. Its slope is

$$\frac{0 - 6}{4 - 0} = -\frac{3}{2},$$

so

$$w(y) = 6 - \frac{3}{2}y.$$

Step 3: Write the force on a horizontal strip. At depth y ,

$$p(y) = 62.4y \text{ lb/ft}^2, \quad dA = w(y) dy.$$

Thus

$$dF = 62.4y \left(6 - \frac{3}{2}y \right) dy.$$

Step 4: Integrate and evaluate.

$$\begin{aligned} F &= 62.4 \int_0^4 y \left(6 - \frac{3}{2}y \right) dy \\ &= 62.4 \int_0^4 \left(6y - \frac{3}{2}y^2 \right) dy \\ &= 62.4 \left[3y^2 - \frac{1}{2}y^3 \right]_0^4 \\ &= 62.4(48 - 32) = 62.4(16) = 998.4 \text{ lb.} \end{aligned}$$

$$\boxed{F = 998.4 \text{ lb}}$$