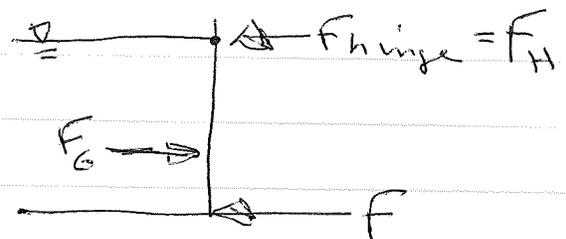


PROBLEM 3.69

3.69 A rectangular gate is hinged at the water-line, as shown. The gate is 4 ft high and 10 ft wide. The specific weight of water is  $62.4 \text{ lbf/ft}^3$ . Find the necessary force (in lbf) applied at the bottom of the gate to keep it closed.

$$F_G = \bar{p}A = \gamma \times 2 \times 4 \times 10 = 4992 \text{ lbf}$$



$$y_{cp} = \bar{y} + \frac{\bar{I}}{\bar{y}A}$$

$$y_{cp} = 2 + \frac{53.33}{2 \times 40}$$

$$= 2.67 \text{ ft below datum}$$

$s = 10$       horizontal centroidal axis  
 $4 = h$   
 $\bar{I} = \frac{sh^3}{12} = 53.33 \text{ ft}^3$

$$\sum M_H = F_G \times 2.67 - F \times 4 \Rightarrow F = 3332 \text{ lbf}$$

$$\sum F_x = 0 \quad F_G - F_H - F = 0$$

$$F_H = F_G - F = 1660 \text{ lbf}$$