2.61

2.61 A homogeneous, 4-ft-wide, 8-ft-long rectangular gate weighing 800 lb is held in place by a horizontal flexible cable as shown in Fig. P2.61 Water acts against the gate which is hinged at point *A*. Friction in the hinge is negligible. Determine the tension in the cable.

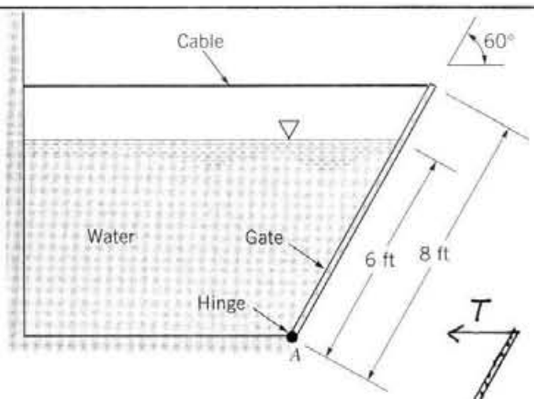
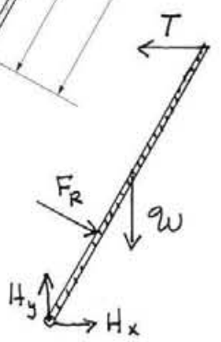


FIGURE P2.61



$F_R = \gamma h_c A$ where $h_c = \left(\frac{6ft}{2}\right) \sin 60°$

Thus,

$$F_R = \left(62.4 \frac{lb}{ft^3}\right)\left(\frac{6 ft}{2}\right)(\sin 60°)(6ft \times 4ft)$$

$$= 3890 \text{ lb}$$

To locate F_R,

$$y_R = \frac{I_{xc}}{y_c A} + y_c \quad \text{where} \quad y_c = 3ft$$

so that

$$y_R = \frac{\frac{1}{12}(4ft)(6ft)^3}{(3 ft)(6ft \times 4ft)} + 3ft = 4.0 ft$$

For equilibrium,

$$\Sigma M_H = 0$$

and

$$T(8ft)(\sin 60°) = W(4ft)(\cos 60°) + F_R(2 ft)$$

$$T = \frac{(800 lb)(4ft)(\cos 60°) + (3890 lb)(2 ft)}{(8 ft)(\sin 60°)}$$

$$= \underline{\underline{1350 \text{ lb}}}$$