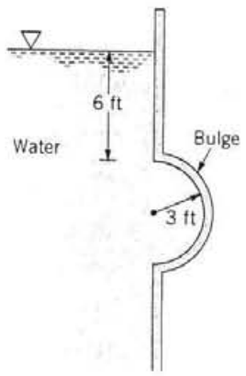
2.92

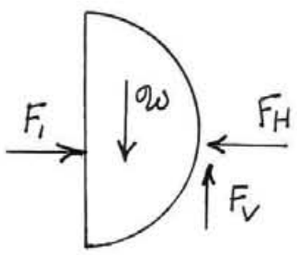
2.92 An open tank containing water has a bulge in its vertical side that is semicircular in shape as shown in Fig. P2.92. Determine the horizontal and vertical components of the force that the water exerts on the bulge. Base your analysis on a 1-ft length of the bulge.



■ FIGURE P2.92

F_H ~ horizontal force of wall on fluid

F_V ~ vertical force of wall on fluid



$$\mathcal{W} = \gamma_{H_2O} \forall_{vol}$$

$$= \left(62.4 \frac{lb}{ft^3}\right)\left(\frac{\pi (3ft)^2}{2}\right)(1\ ft)$$

$$= 882\ lb$$

$$F_1 = \gamma h_c A = \left(62.4 \frac{lb}{ft^3}\right)(6ft + 3ft)(6ft \times 1ft)$$

$$= 3370\ lb$$

For equilibrium, $F_V = \mathcal{W} = 882\ lb \uparrow$

and $F_H = F_1 = 3370\ lb \leftarrow$

The force the water exerts <u>on</u> the bulge is equal to, but opposite in direction to F_V and F_H above. Thus,

$$(F_H)_{wall} = 3370\ lb \rightarrow$$

$$(F_V)_{wall} = 882\ lb \downarrow$$