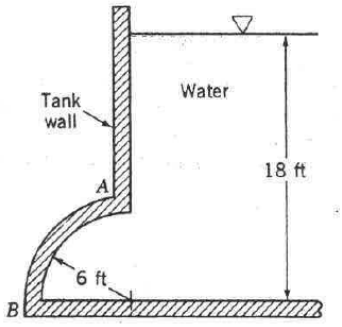
September 19, 2016

NAME

Quiz 3. A tank wall has the shape shown in the figure. The length of the tank (into to the paper) is 4-ft. (Υ_{water}=62.4 lb/ft^3)



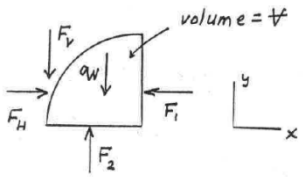
(a) Determine the magnitude and location of the horizontal component of the force on curved section AB.

(Hint: Moment of inertia for a rectangle $I = \frac{bh^3}{12}$)

(b) Determine the magnitude of the vertical component of the force on curved section AB. (Hint: Area of quarter circle is $\frac{\pi r^2}{4}$)

Note: Attendance (+2 points), Format (+1 point)

Solution:



(a)

$$F_H = F_1 = \gamma h_{c1} A_1$$ (+2 point)

$$F_H = \left(62.4 \frac{lb}{ft^3}\right)(15\ ft)(6 \times 4 ft^2) = 22\,500\ lb$$ (+0.5 point)

$$y_H = \frac{I}{y_c A_1} + y_c$$ (+1.5 point)

$$y_H = \frac{\frac{4\times 6^3}{12} ft^4}{(15\ ft)(6\times 4 ft^2)} + 15\ ft = 15.2\ ft$$ (+0.5 point)

(b)

$$F_2 = \gamma h_{c2} A_2$$

$$W = \gamma V$$

$$F_V = F_2 - W = \gamma[h_{c2} A_2 - V]$$ (+2 point)

$$F_V = \left(62.4 \frac{lb}{ft^3}\right)\left[(18 ft)(6 \times 4\ ft) - \left(\frac{\pi 6^2 ft^2}{4}\right)(4\ ft)\right] = 19\,900\ lb$$ (+0.5 point)

Alternative way of calculating vertical force

$$F_V = \gamma V$$ (+2 point)

V is the volume above dome

$$F_V = \left(62.4\frac{lb}{ft^3}\right)(18 \times 6 \times 4\ ft^3 - \pi 6^2 \times 4\ ft^3/4) = 19\ 900\ lb$$ (+0.5 point)