41

Tyler Crouse
HW 1.3
9/18/24

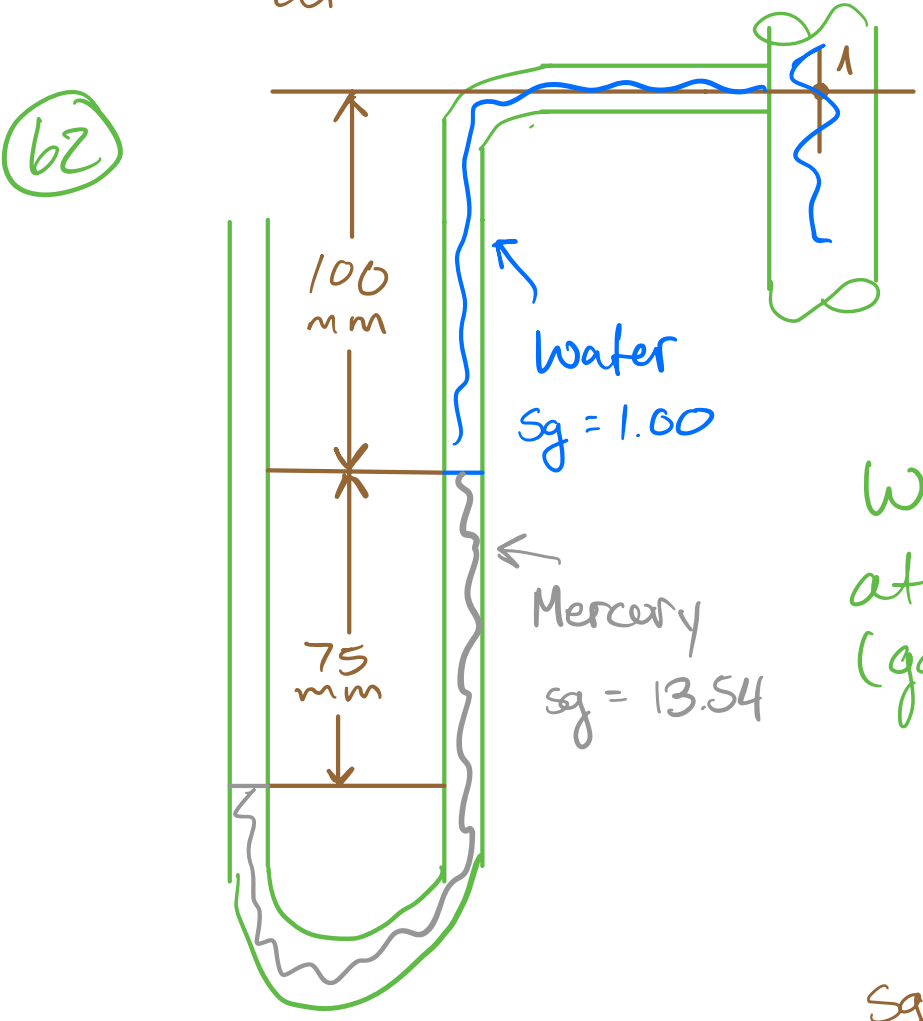
What is the tank Pressure at 3.0m?

$\Delta p = \gamma h$

$\gamma_{EG} = 10.79\ kN/m^3$

$\Delta p = \gamma_{EG} h_{EG} = (10.79\ kN/m^3)(3.0m) = \boxed{32.37\ kPa}$

62



What is the pressure at point A in kPa (gage).

$\Delta p = \gamma h$

$Sg = \frac{\gamma_L}{\gamma_{w@4^oC}}$

$$\gamma_m = Sg(\gamma_{w@4^oC}) = 9.807\ kN/m^3\ (13.54) = 132.8\ kN/m^3$$

$$\Delta p_A = \Delta p_m + \Delta p_w$$

$$\Delta p_A = (\gamma_m)(h_m) + (\gamma_w)(h_w)$$

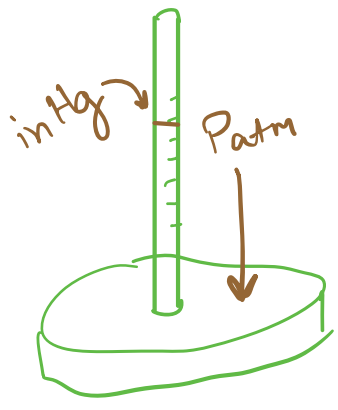
$$\Delta p_A = \left(132.8\ kN/m^3\right)(75\ mm)\left(1\ m/1000\ mm\right) + \left(9.807\ kN/m^3\right)(100\ mm)\left(1\ m/1000\ mm\right)$$

$$\Delta p_A = 9.96\ kPa + 0.981\ kPa = \boxed{10.94\ kPa}$$

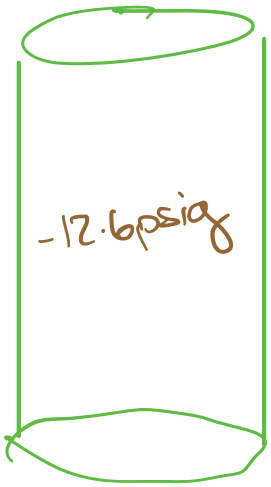
(63) What is the gage pressure on a barometer (inHg) if atmospheric pressure is 14.2psia.

$$\gamma_{Hg} = 848.7\ lb/ft^3$$

$$h = \frac{p_{atm}}{\gamma_{Hg}} = \frac{14.2\ lb}{in^2} \cdot \frac{1\ ft^3}{848.7\ lb} \cdot \frac{1728\ in^3}{1\ ft^3} = 28.9\ inHg$$



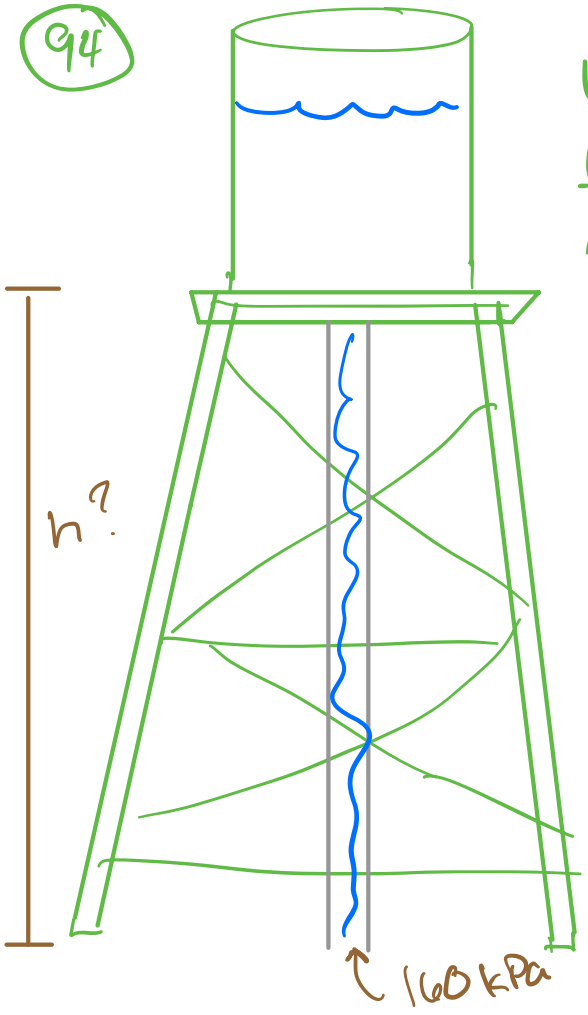
(90)



What is the pressure in in Hg.

$$\frac{-12.6\,lb}{in^2} \cdot \frac{1\,ft^3}{848.7\,lb} \cdot \frac{1728\,in^3}{1\,ft^3} = -25.65\,in\,Hg$$

(94)

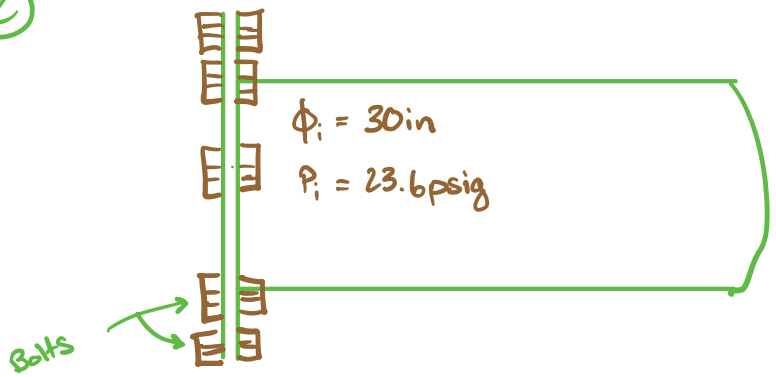


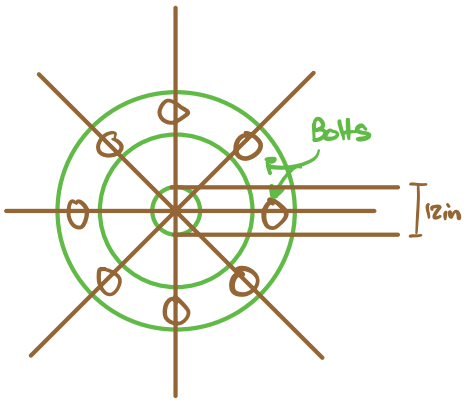
What tank elevation is required for a minimum gage pressure of 160 kPa at the outlet with static water.

$$\Delta P = \gamma_w h$$

$$h = \frac{\Delta P_w}{\gamma_w} = \frac{160\,kN}{m^2} \cdot \frac{m^3}{9.807\,kN} = 16.3m$$

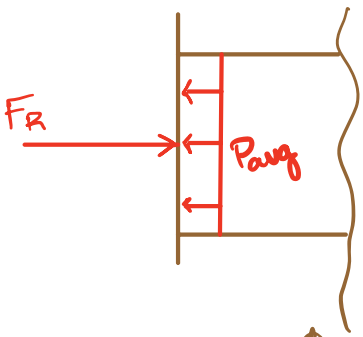
(2)





Calculate total force of resistance (F_R) by bolts.

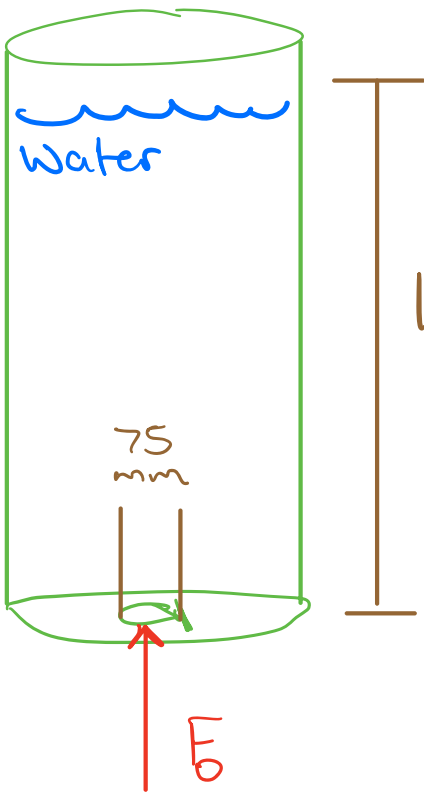
$$A_w = \pi \frac{d^2}{4} = \frac{\pi (30in)^2}{4} = 706.5in^2$$



$$F_R = P_{avg} A_w = (23.6\,psig)(706.5in^2) = 16,673lb$$

(10)

How much force (F_o) is required to open flap at bottom?



$$F_o = P_w A_v \qquad P_w = \gamma_w V_w$$

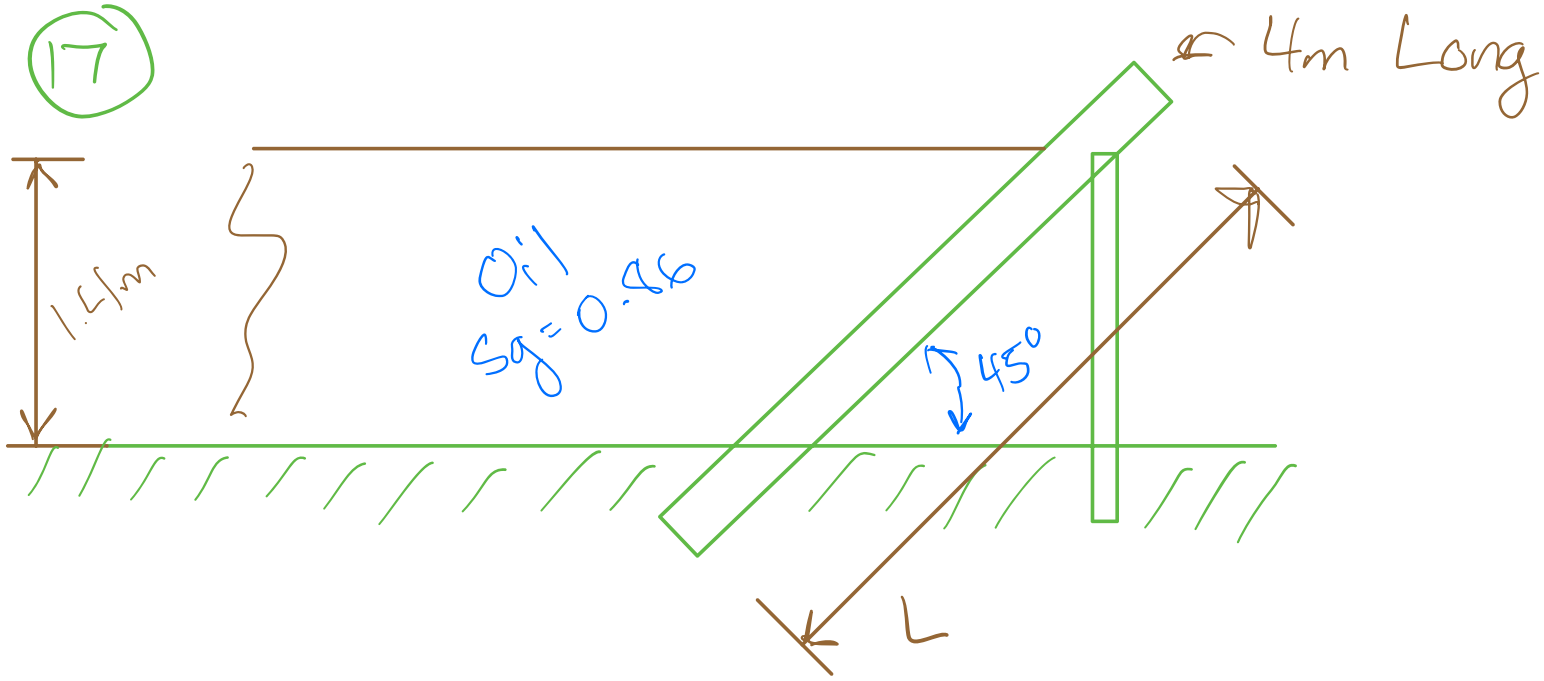
$$F_o = (\gamma_w V_w) A_v = \gamma_w (A_w h_w) A_v$$

1.925

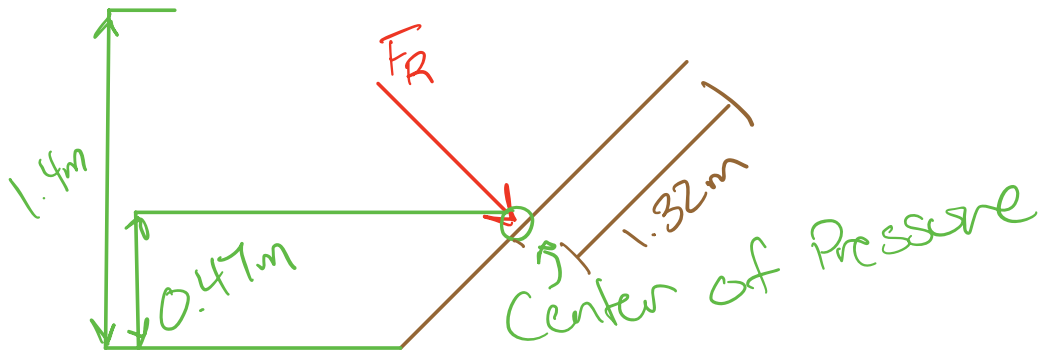
$$F_o = 9.807\,kN/m^3 \left(\pi \frac{500^2}{4}\right)_{mm^2} \left(1m^2/1\times10^6 mm^2\right) \quad 1.80m$$

$$\left(\pi \frac{75^2}{4}\right)_{mm^2} \left(1m^2/1\times10^6 mm^2\right) = \boxed{0.0153}$$

17

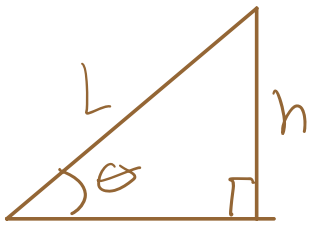


Calculate total force (F_T) on wall. Also, determine location of the center of pressure and show resultant force on wall.



$$F_R = \gamma (h/2) A$$

$$\sin\theta = \frac{h}{L}$$



$$L = \frac{h}{\sin\theta} = \frac{1.4m}{\sin(45)} = 1.98m$$

$$A = (1.98m)(4m) = 7.92m^2$$

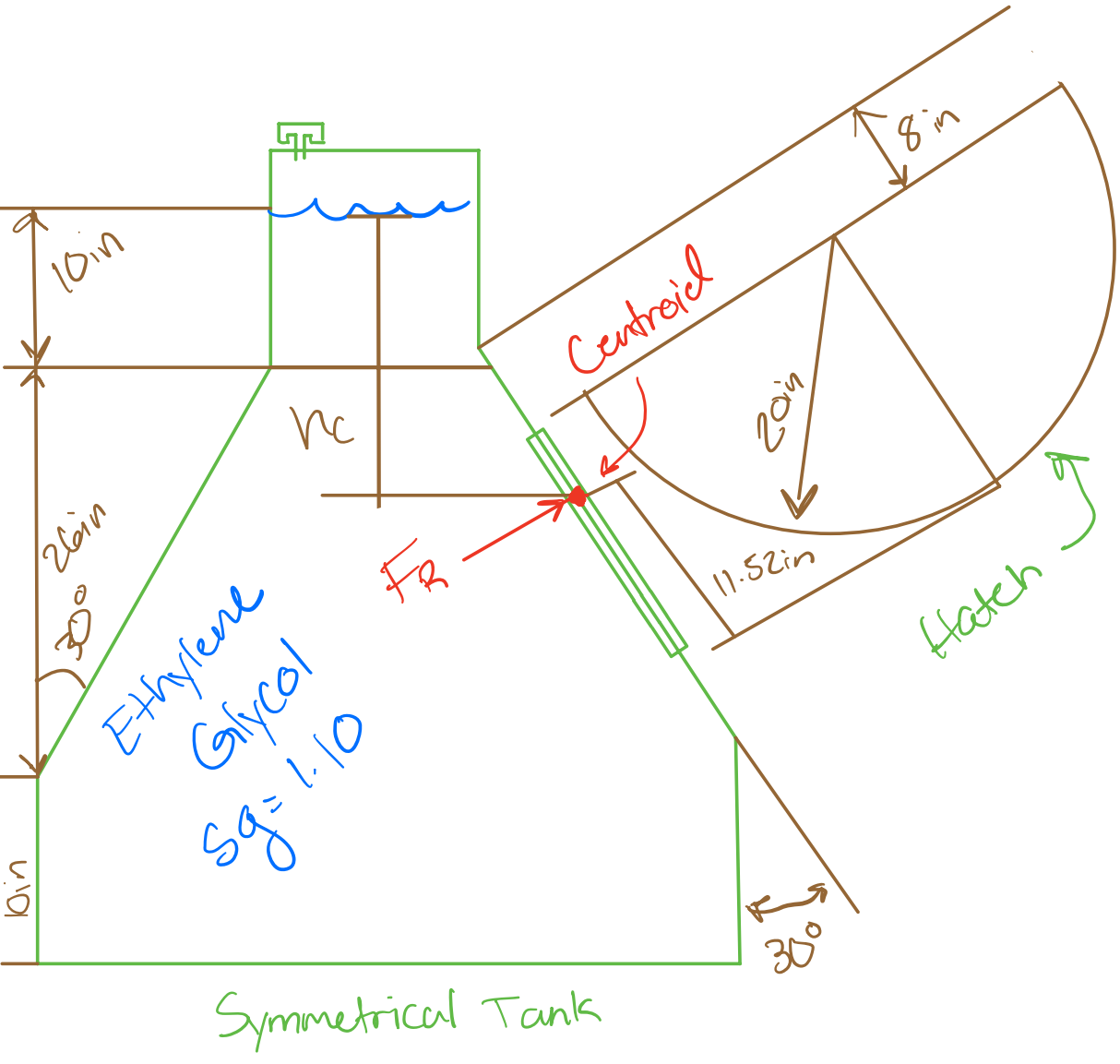
$$\gamma_o = Sg_o(\gamma_w) = 0.86\left(9.807\,kN/m^3\right) = 8.43\,kN/m^3$$

$$F_R = \left(8.43\,kN/m^3\right)(1.4m/2)\left(7.92m^2\right) = \boxed{93.5\,kN}$$

$$L_p = 1.98m - (1.98m/3) = 1.32m$$

∴ The center of pressure is at 1.32m below the surface of the oil when measured along the dam wall. The resultant force acts at a perpendicular angle to the wall at this point.

(26) Compute magnitude of resulting force on area and its center of pressure. Show force on area with dimentions.



Symmetrical Tank

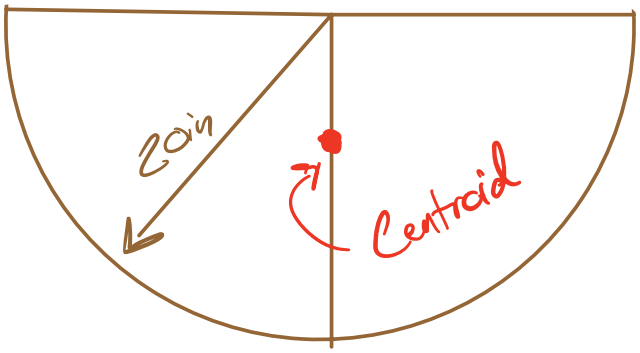
$$F = \gamma \cdot hc \cdot A \qquad \gamma_w = 62.4\ lb/ft^3$$

$$Lp = Lc + \frac{Ic}{Lc \cdot A} \qquad A = \pi \frac{d^2}{8}$$

$$Ic = 6.86 \times 10^{-3} (d^4)$$

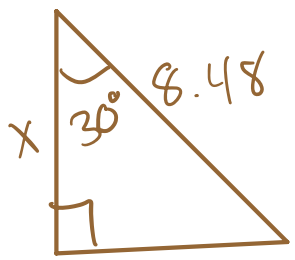
$\bar{y} = 0.212d$

Hatch



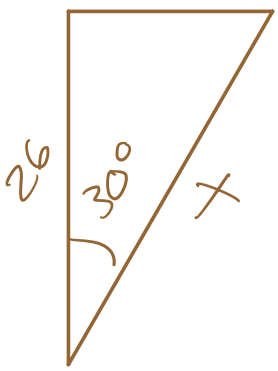
8.48in

$\bar{y} = 0.212(40in) = 8.48in$



$\cos(30) = \frac{x}{8.48}$

$x = 8.48(\cos(30)) = 7.34in$



$\cos(30) = \frac{26}{x}$

$x = \frac{26}{\cos(30)} = 30.02in$

$8 + (20 - 11.52) = 16.48$