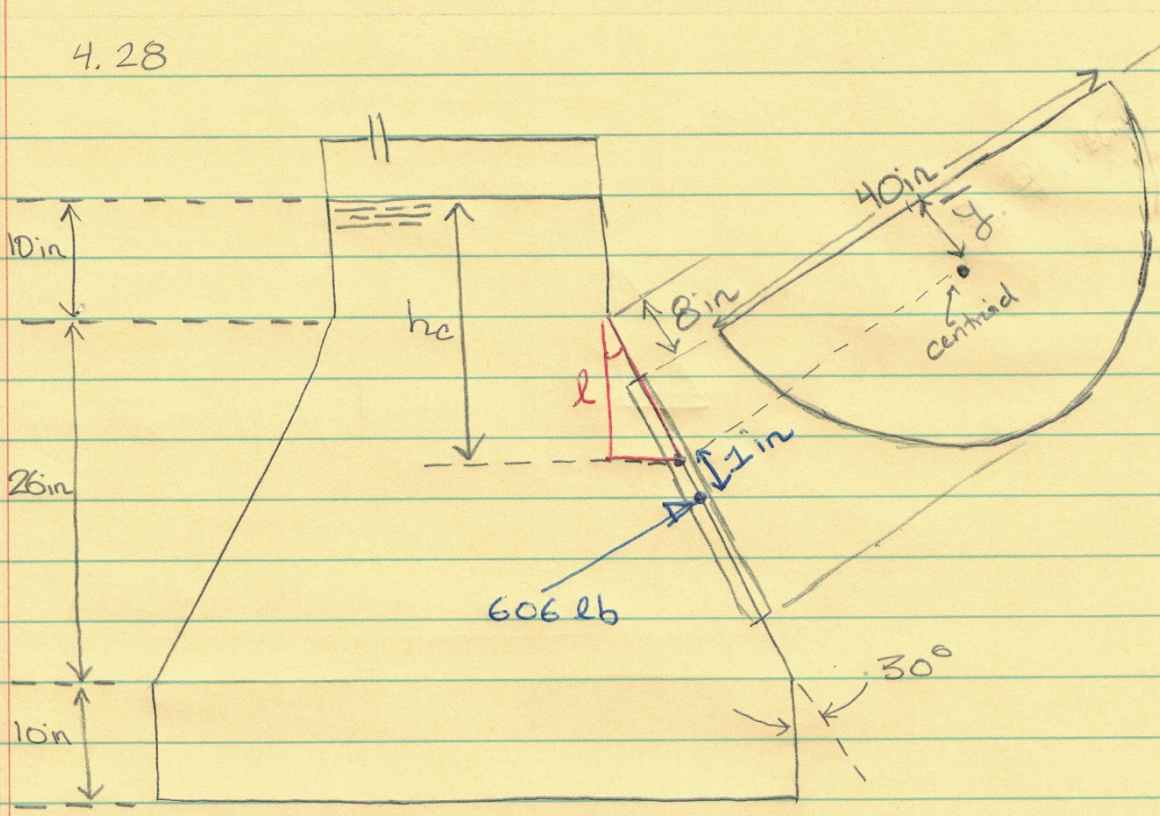
4.28

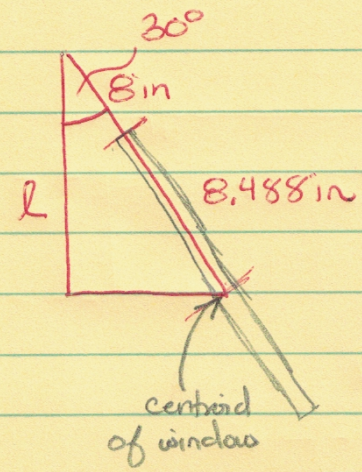


First we want to find vertical depth to centroid, h_c.

From eqn sheet centroid of semi-circle is located at

$$\bar{y} = \frac{2D}{3\pi} = \frac{2(40\text{ in})}{3\pi} = 8.488\text{ in}$$

h_c will be 10 in plus the distance I called ℓ: $h_c = 10\text{ in} + \ell$



The hypotenuse is $8. + 8.488 = 16.488\ in$

$$\cos 30^\circ = \frac{\ell}{16.488} \Rightarrow \ell = 14.279\ in$$

$$h_c = 10\ in + \ell = 24.279\ in$$

The resultant force is

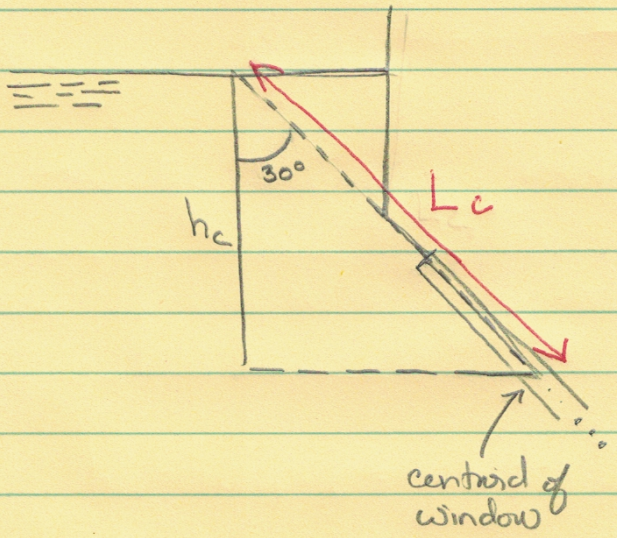
$$F_R = \gamma h_c A \quad \text{where} \quad A = \frac{\pi D^2}{8} = \frac{\pi (40\ in)^2}{8} = 628.32\ in^2$$

$$F_R = (1.10)\left(62.4\ \frac{lb}{ft^3}\right)\left(\frac{1\ ft}{12\ in}\right)^3 (24.279\ in)(628.32\ in^2)$$

$$F_R = 605.96\ lb \Rightarrow \boxed{F_R = 606\ lb}$$

Now find location of center of pressure

$$L_p - L_c = \frac{I_c}{L_c A}$$



$$\cos 30° = \frac{h_c}{L_c}$$

$$L_c = \frac{h_c}{\cos 30}$$

$$L_c = \frac{24.279\,in}{\cos 30} = 28.03\,in$$

$$I_c = \left(\frac{\pi}{128} - \frac{1}{18\pi}\right) D^4 = 0.0068598\,(40\,in)^4$$

$$I_c = 17561.1\,in^4$$

$$L_p - L_c = \frac{I_c}{L_c A} = \frac{17561.1\,in^4}{(28.03in)(628.32in^2)} = 0.997\,in$$

My final answer is drawn in blue on pg 1