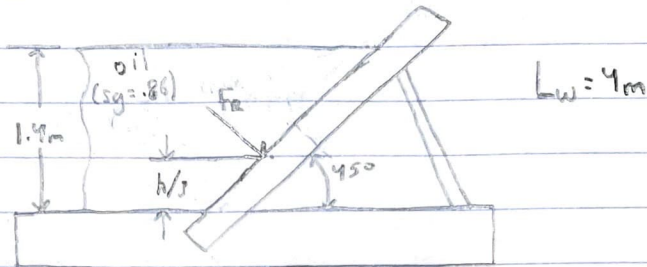


Cameron Sutton

HW 2.1

4.17.) Determine: Force on wall due to oil pressure and location of the center of pressure.

Given:



Solution: $Sg = \frac{\gamma_{oil}}{\gamma_w @ 4^\circ C}$

$$.86 = \frac{\gamma_{oil}}{9.81 \text{ kN/m}^3}$$

$$\gamma_{oil} = 8.44 \text{ kN/m}^3$$

$$L = \frac{h}{\sin \theta} = \frac{1.4 \text{ m}}{\sin 45^\circ} = 1.98 \text{ m}$$

$$A = (4 \text{ m})(1.98 \text{ m}) = 7.92 \text{ m}^2$$

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

$$F_R = 8.44 \text{ kN/m}^3 \left(\frac{1.4 \text{ m}}{2} \right) 7.92 \text{ m}^2$$

$$F_R = 46.79 \text{ kN}$$

$$\text{Center of pressure: } h/3 = \frac{1.4 \text{ m}}{3} = .47 \text{ m}$$

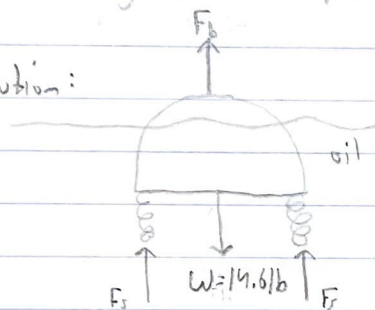
5.8.) Determine: Calculate supporting force exerted by the springs

Given:



$$\text{oil } sg = 0.90 \quad W_p = 14.6 \text{ lb} \quad V_d = 40 \text{ in}^3$$

Solution:



$$\uparrow \sum F_y = 0$$

$$-14.6 \text{ lb} + F_b + F_s = 0$$

$$F_b = \gamma_{\text{oil}} V_d$$

$$F_b = (56.2 \text{ lb/ft}^3)(0.023 \text{ ft}^3)$$

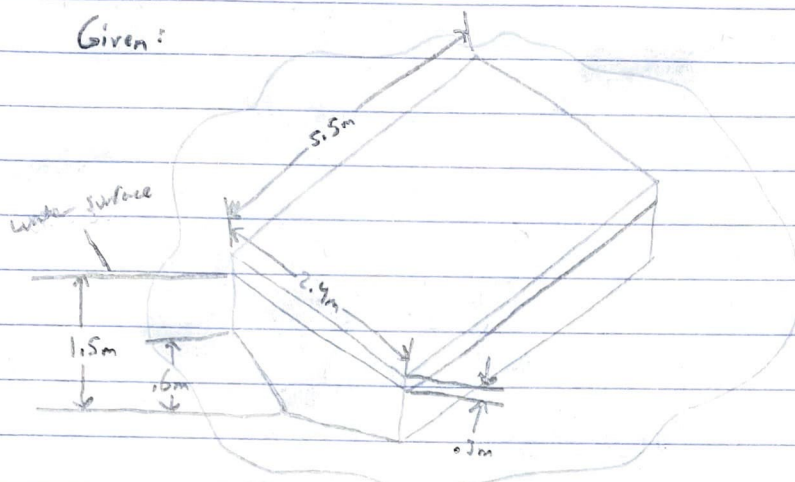
$$F_b = 1.29 \text{ lb}$$

$$-14.6 \text{ lb} + 1.29 \text{ lb} + F_s = 0$$

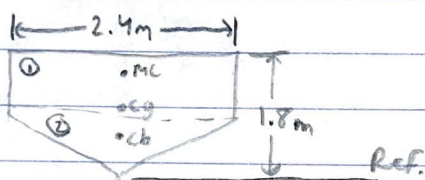
$$F_s = 13.3 \text{ lb}$$

5.61.) Determine: Is the boat stable?

Given:



Solution:



$$A = (2.4m)(1.2m) + \left(\frac{1}{2}\right)(2.4m)(.6m)$$

$$A = 2.88 + .72$$

$$A = 3.6m^2$$

$$\text{Submerged Area} = (2.4m)(.9m) + \left(\frac{1}{2}\right)(2.4m)(.6m)$$

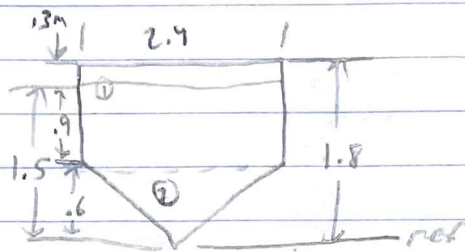
$$A = 2.88m^2$$

$$V_d = A_{sub} \times L$$

$$V_d = 2.88m^2 \times 5.5m$$

$$V_d = 15.84m^3$$

$$I = \frac{bh^3}{12} = \frac{(5.5)(2.4)^3}{12} = 6.34m^4$$



$$1) A_{sub} = (2.4)(.9) = 2.16 \text{ m}^2$$

$$I_c = \frac{bh^3}{12} = \frac{(5.5)(2.4)^3}{12} = 6.376 \text{ m}^4$$

$$y_i = 1.2 - 0.3 = 0.9 \text{ m}$$

$$y_i A_i = (2.16)(.9) = 1.94 \text{ m}^2$$

$$y_i^2 A_i = (.9)^2 (2.16) = 1.72$$

$$2) A_{sub} = \frac{1}{2} (2.4)(.6) = .72 \text{ m}^2$$

$$I_c = 6.376 \text{ m}^4$$

$$y_i = .3 \text{ m}$$

$$y_i A_i = (.3)(.72) = .22 \text{ m}^2$$

$$\bar{y} = \frac{y_i A_i + y_i A_i}{A_1 + A_2}$$

$$\bar{y} = \frac{1.94 + .22}{2.16 + .72}$$

$$\bar{y} = .75 \text{ m}$$

$$MB = \frac{I}{V_d} = \frac{6.376 \text{ m}^4}{15.87 \text{ m}^3} = .4 \text{ m}$$

$$y_{mc} = y_{cb} + MB$$

$$y_{mc} = .75 \text{ m} + .4 \text{ m}$$

$$y_{mc} = 1.15 \text{ m}$$

Yes, the boat is stable because $y_{mc} > y_{cg}$.