

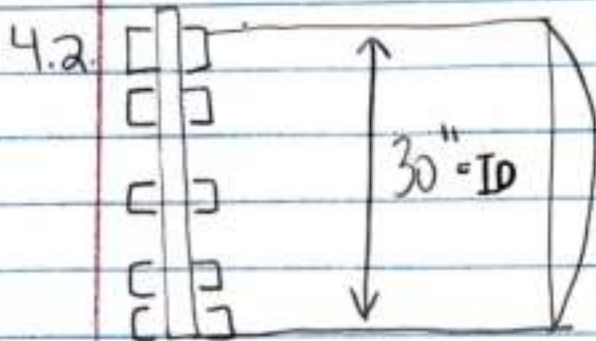
Dylan Arnold
MET 330

UID: 01166349

HW3

Summer 2023

May 30th 2023



$$P = 14.4 \text{ psig}$$

$$F = pA$$

$$A = \frac{\pi D^2}{4} = \frac{\pi (30")^2}{4} = 706.86 \text{ in}^2$$

$$F = \frac{14.4 \text{ lb}}{\text{in}^2} \times 706.86 \text{ in}^2 = \boxed{10,178.78 \text{ lb}}$$

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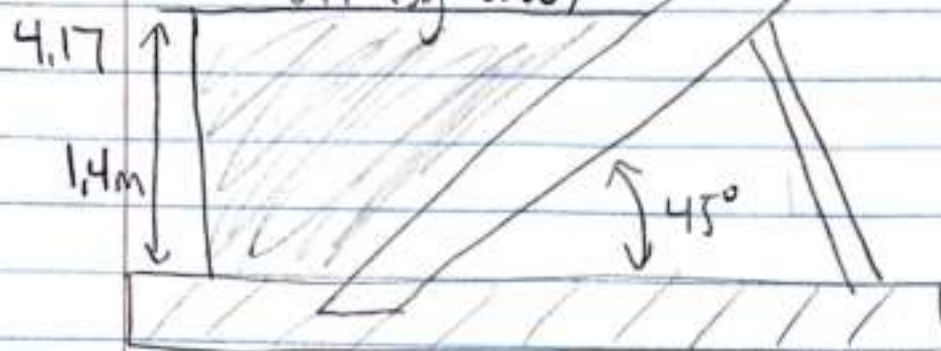
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oil ($\rho = 0.86$)

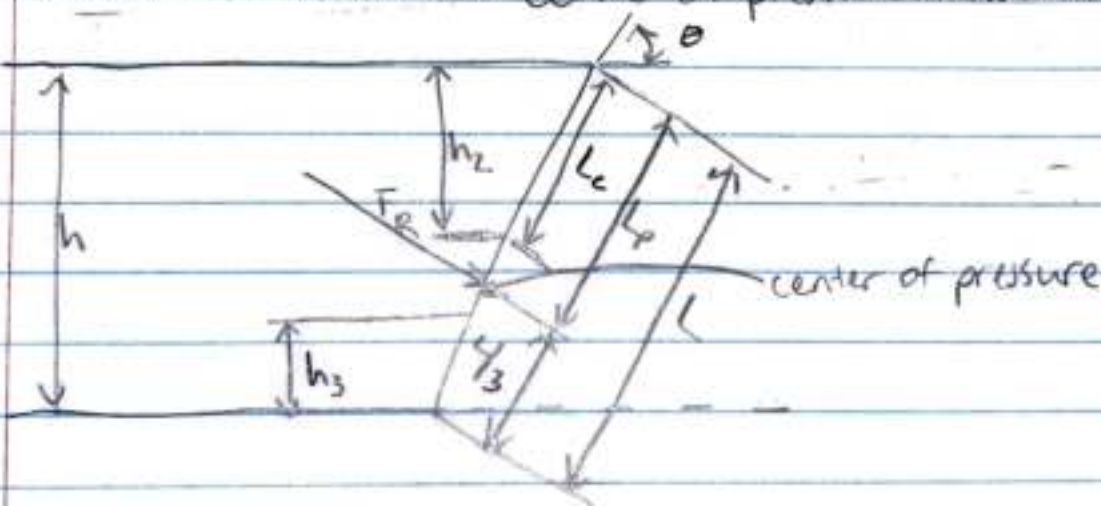
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Wall length = 4m

What is force on wall due to oil pressure?

What is location of center of pressure resultant force?



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

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$$\sin \theta = h/L$$

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

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

$$F_R = \gamma(h/2)A = \gamma_{oil} = 0.86 = \frac{\gamma_{oil}}{9.81\text{ kN/m}^3}$$

$$0.86 \times 9.81\text{ kN/m}^3 = 8.44\text{ kN/m}^3$$

$$F_R = \frac{8.44\text{ kN}}{\cancel{\text{m}^3}} \times \frac{1.4\text{m}}{2} \times 7.92\text{m}^2 = \frac{96.7}{2}$$

$$= 48.35\text{ kN} \quad F_R$$

$$h/3 = 1.4\text{m}/3 = 0.47\text{m} \quad h_p = 1.4 - 0.47 = \boxed{0.93\text{m}}^{h_p}$$

$$L/3 = 1.98\text{m}/3 = 0.66\text{m}$$

$$L_p = 1.98\text{m} - 0.66\text{m} = \boxed{1.32\text{m}} \quad L_p$$

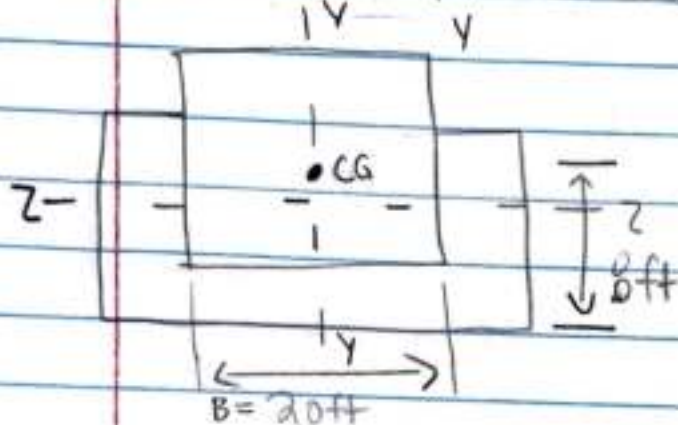
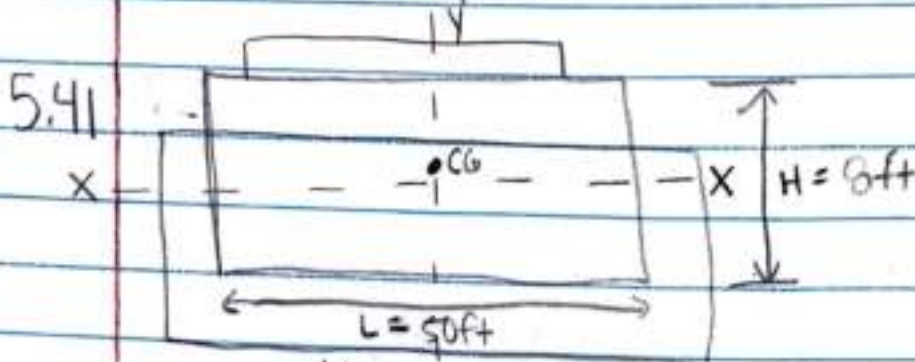
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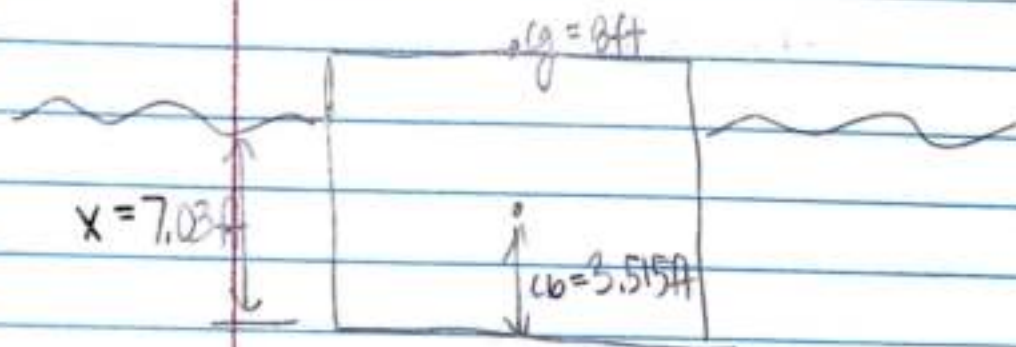
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$$\gamma_{\text{seawater}} = 64 \frac{\text{lb}}{\text{ft}^3}$$

$$X = \frac{W}{B \times L \times \gamma_f} = \frac{450,000 \text{ lb}}{20\text{ft} \times 50\text{ft} \times 64 \frac{\text{lb}}{\text{ft}^3}} = 7.03\text{ft}$$



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$$MB = I/V_d$$

$$V_d = L \times B \times X = 50\text{ft} \times 20\text{ft} \times 7.03\text{ft} = 7030\text{ft}^3$$

$$I = \frac{LB^3}{12} = \frac{(50\text{ft})(20\text{ft})^3}{12} = 33,333.33\text{ft}^4$$

$$MB = \frac{33,333.33\text{ft}^4}{7030\text{ft}^3} = 4.74\text{ft}$$

$$\text{Meta Center} = 4.74\text{ft} + 3.515\text{ft} = \boxed{8.255\text{ft}}$$

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

Yes, the boat is stable. $8.255\text{ft} > 8\text{ft}$

$$MC > CG$$

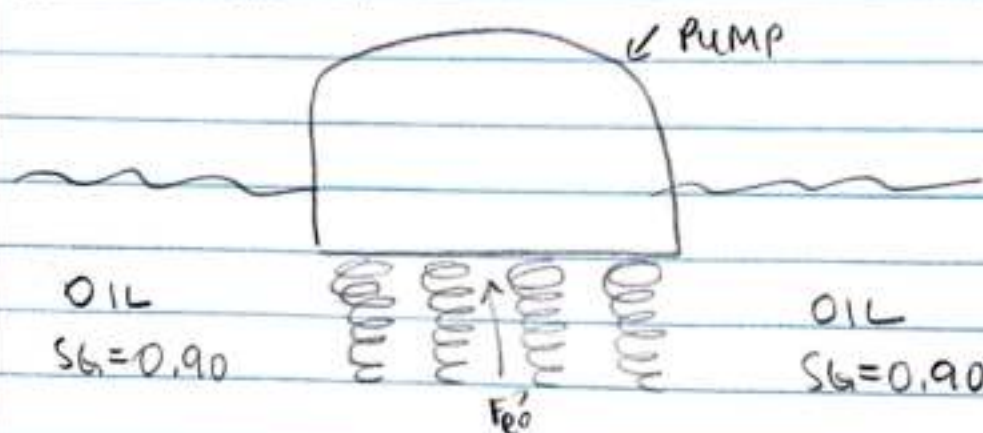
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5.8



Total weight = 14.6 lb

Submerged volume = 40 in³

What is supporting force exerted by springs?

$$F_b = \gamma_f V_d$$

$$SG_{oil} = 0.90 = \frac{\gamma_{oil}}{62.4 \text{ lb/ft}^3} \quad \gamma_{oil} = 56.16 \text{ lb/ft}^3$$

$$F_b = 56.16 \frac{\text{lb}}{\text{ft}^3} \times 40 \text{ in}^3 \times \frac{\text{ft}^3}{1728 \text{ in}^3}$$

$$F_b = 1.3 \text{ lb}$$

$$F_e = W - F_b = 14.6 \text{ lb} - 1.3 \text{ lb}$$
$$\boxed{F_e = 13.3 \text{ lb}}$$

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