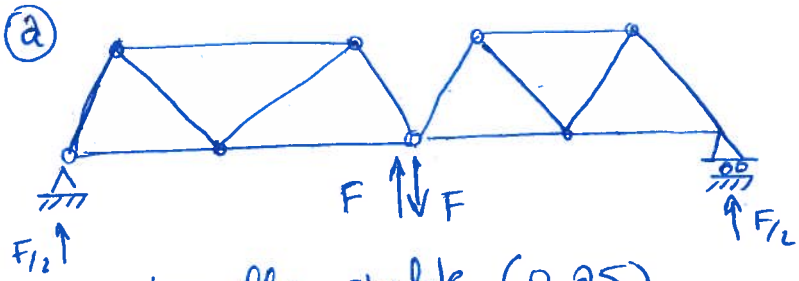
Quiz # 1: Solutions.

Problem 1:

(a)



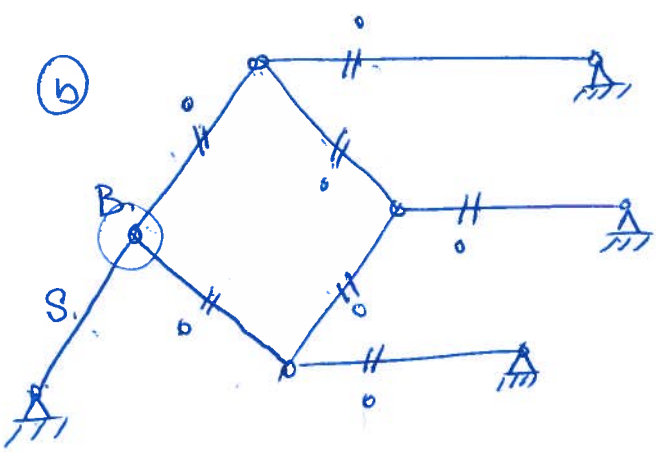
externally: stable (0.25)

internally: unstable (0.25)

$n = m + r - 2j = 14 + 3 - 2 \times 9 = \boxed{-1}$ (0.25)

Counter example: $F/2 \times \ell = 0 \rightarrow F = 0$: not true.

(b)



complex truss

external: stable (0.25)

internal: stable (0.25)

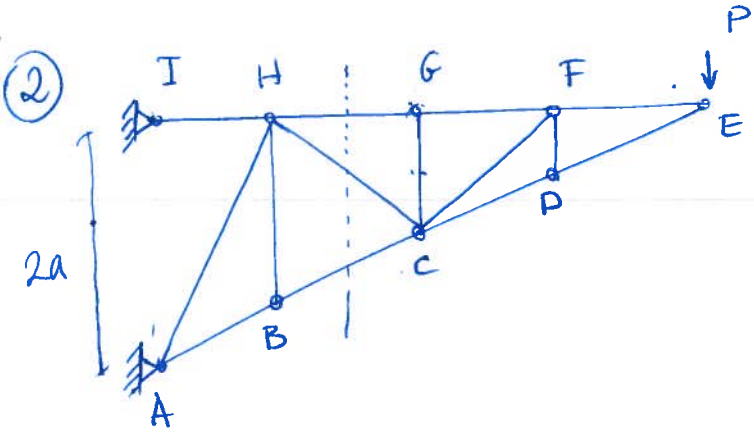
$n = m + r - 2j = 8 + 4 \times 2 - 2 \times 8 = \boxed{0}$

(0.25)

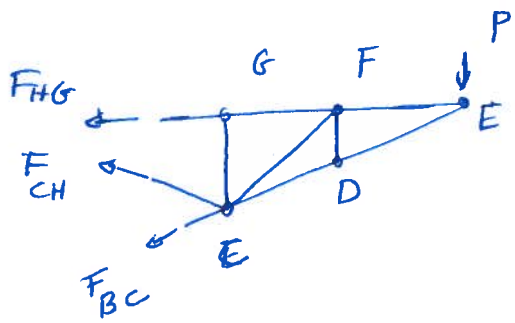
S method: S should be zero based on zero force method. (0.25)

Consider equilibrium at joint B, this requires $\boxed{S = 0}$

(2)



HG and HC:

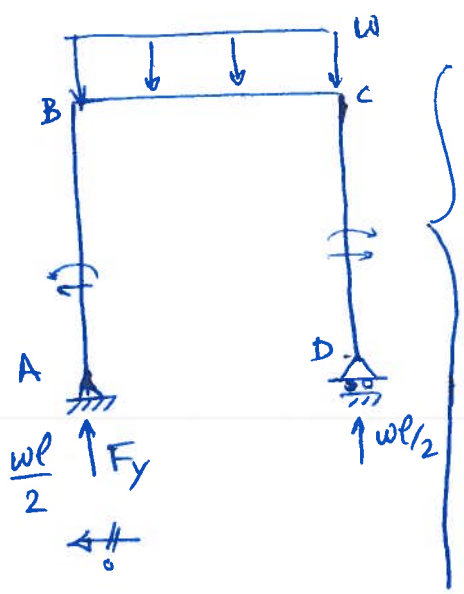


$$\sum M_C = 0 \rightarrow P \times 2\cancel{a} - F_{HG} \times \cancel{a} = 0$$

$$\rightarrow \boxed{F_{HG} = 2P} \quad (0.5)$$

$$\sum M_E = 0 \rightarrow F_{CH} \times \ell = 0 \rightarrow \boxed{F_{CH} = 0} \quad (0.5)$$

(3)

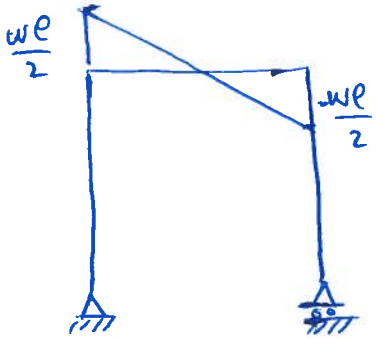


$F_A^y = w\ell/2$ $\quad F_D^y = \frac{w\ell}{2}$ $\quad (0.5)$

$\cancel{\Sigma} F_A^x = 0$

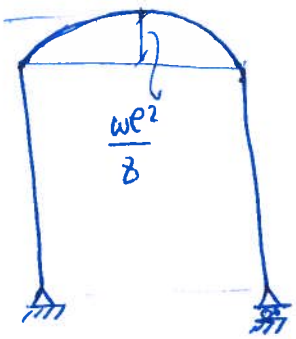
AB & CD : $V = 0$, $M = 0$

BC : $\begin{cases} V = w\ell/2 - wx \\ M = \frac{w\ell}{2} \cdot x - \frac{wx^2}{2} \end{cases}$ $\quad (0.5)$



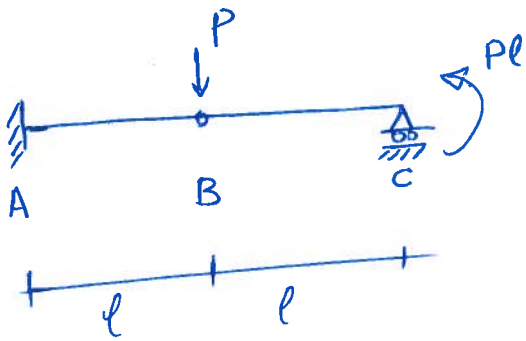
shear

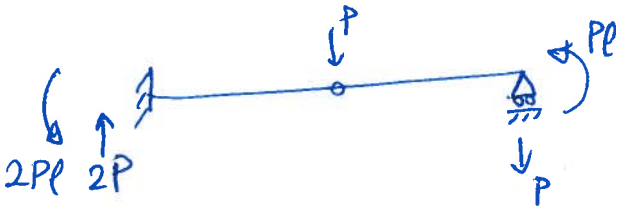
(0.5)



(0.5)

(4)





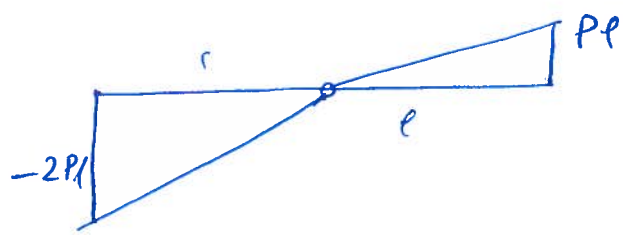
→ (0.5)

$F_A^y = 2P$

$M_A = 2Pl$

$F_C^y = -P$

(0.25)



(0.25)