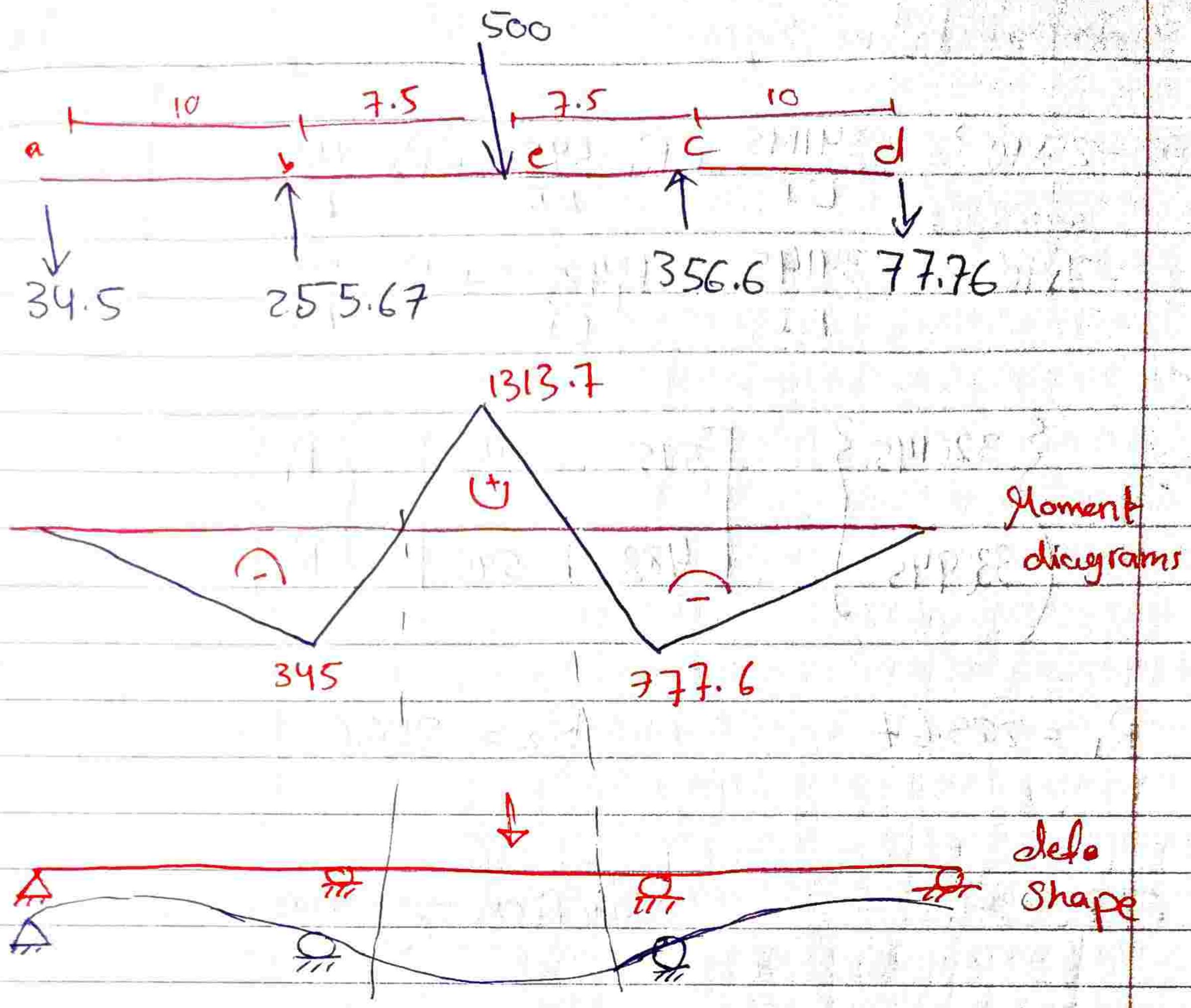
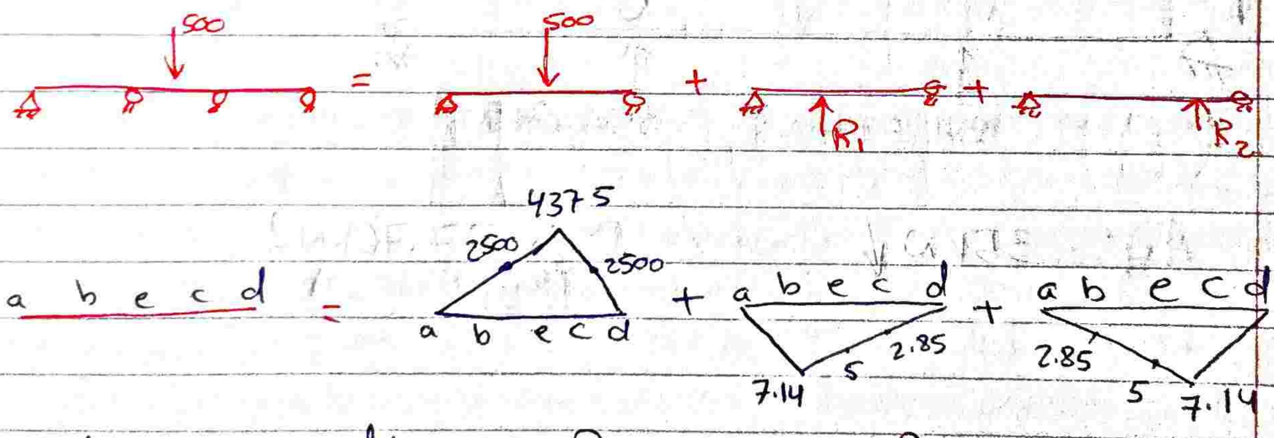




$$M = M_0 + R_1 m_1 + R_2 m_2$$

$R_1 = 255.67$

$R_2 = 356.6$

$\nearrow M_0$ $\quad R_1 m_1$ $\quad R_2 m_2$

$$M_b = +2500 + (-7.14)(255.67) + (-2.85)(356.6)$$

$$= -345$$

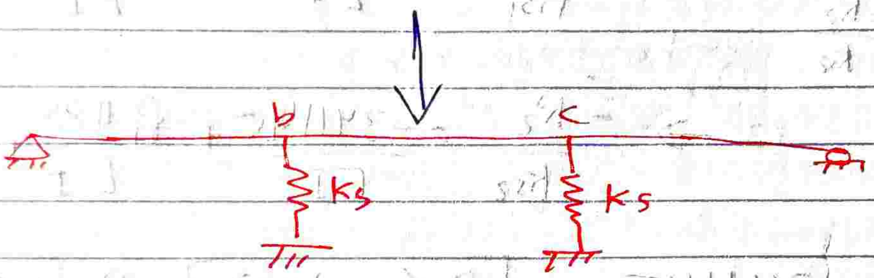
$+ \rightarrow$ above x-axis

$- \rightarrow$ below x-axis

$$M_e = 4375 + (-5 \times 255.67) + (5 \times -356.6)$$

$$= 1313.7$$

and so...



$\Downarrow$

when $K = \infty$

$F = K_s \Delta$

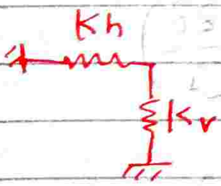
$\frac{F}{K_s} = \Delta$

$K_s \rightarrow \infty$

$\Rightarrow \Delta = 0$

والإزاحة فيها غير معروفة تعتمد على قيمة الرياكشن في الناحيتين وبالتالي قيمة الرياكشن تعتمد على اللود الموجود على البيم

• Example:-

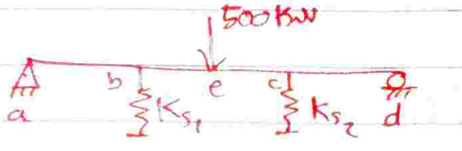


 $\rightarrow$ $K_h = \infty$, $K_v = \infty$

 $\rightarrow$ $K_h = 0$, $K_v = \infty$

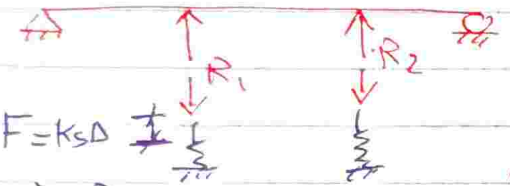
Example: forces in the spring is the redundent.

$K_{s_1} = K_{s_2} = 0.006\,EI$



elastic supports ⟹

⟸ بنحل نفس المثال السابقة
الجهة اليمين ما بتختلف
في معادلة الكومباتبيلتي
بس لقيمة الكلية للمثال هي
اللي بتختلف.



$F = K_s\Delta$

$\Delta = \frac{R_1}{K_{s_1}} = D_b$ $\quad D_c = \frac{R_2}{K_{s_2}}$

إشارتها عكس إشارة D_{11}

(1) $\rightarrow -\frac{R_1}{K_{s_1}} = -\frac{341145}{EI} + R_1\frac{595}{EI} + R_2\frac{488}{EI}$

إشارتها عكس إشارة D_{22}

(2) $\rightarrow -\frac{R_2}{K_{s_2}} = -\frac{341145}{EI} + R_1\frac{488}{EI} + R_2\frac{595}{EI}$

(1) $0 = -\frac{341145}{EI} + \left[R_1\left(\frac{595}{EI}\right) + \frac{R_1}{K_{s_1}}\right] + R_2\left[\frac{488}{EI}\right]$

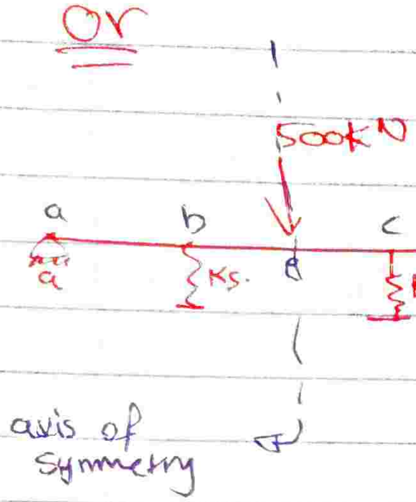
(2) $0 = -\frac{341145}{EI} + R_1\left(\frac{488}{EI}\right) + \left[R_2\left(\frac{595}{EI}\right) + \frac{R_2}{K_{s_2}}\right]$

⇓

(1) $\frac{341145}{EI} = R_1\left[\left(\frac{595}{EI}\right) + \frac{1}{0.006EI}\right] + R_2\left(\frac{488}{EI}\right)$

(2) $\frac{341145}{EI} = R_1\left(\frac{488}{EI}\right) + R_2\left(\frac{595}{EI} + \frac{1}{0.006EI}\right)$

Or



- Is this symmetric system?

yes, (1) $Ks_1 = Ks_2$, (2) dimentions (3) supported, (4) load In the center. (5) EI - cross-section geometry

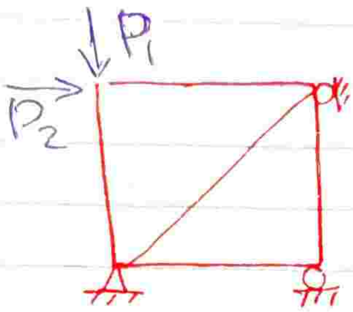
⇒ which this mean

$R_1 = R_2$

So we don't need to solve the two equations

$$R_1 = R_2 = 272.9 \text{ kN}$$

Force Method: Trusses



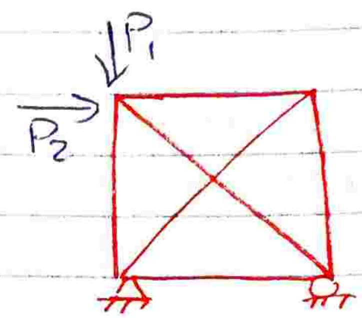
Inde. to 1st degree

- Externally Indet. from the 1st degree
- Internally det.

⇒ $5+4=9 > 4(2)=8$

Statically to 1st degree.

⇒ reaction force is the redundent



Externally 3 (reaction forces) = 3 (equilibrium) equations

- Ind. to 1st degree
- Externally det. $6+3=9 > 4(2)=8$
- Statically Ind. to 1st degree

<< det. Externally >>

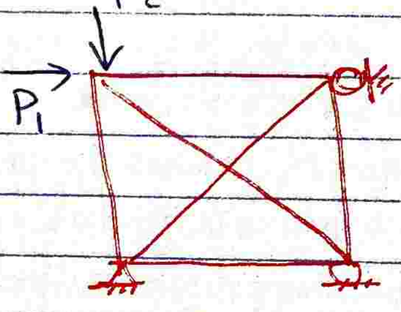
<< indet. to 1st degree >> internally

⇒ member force (redundent).

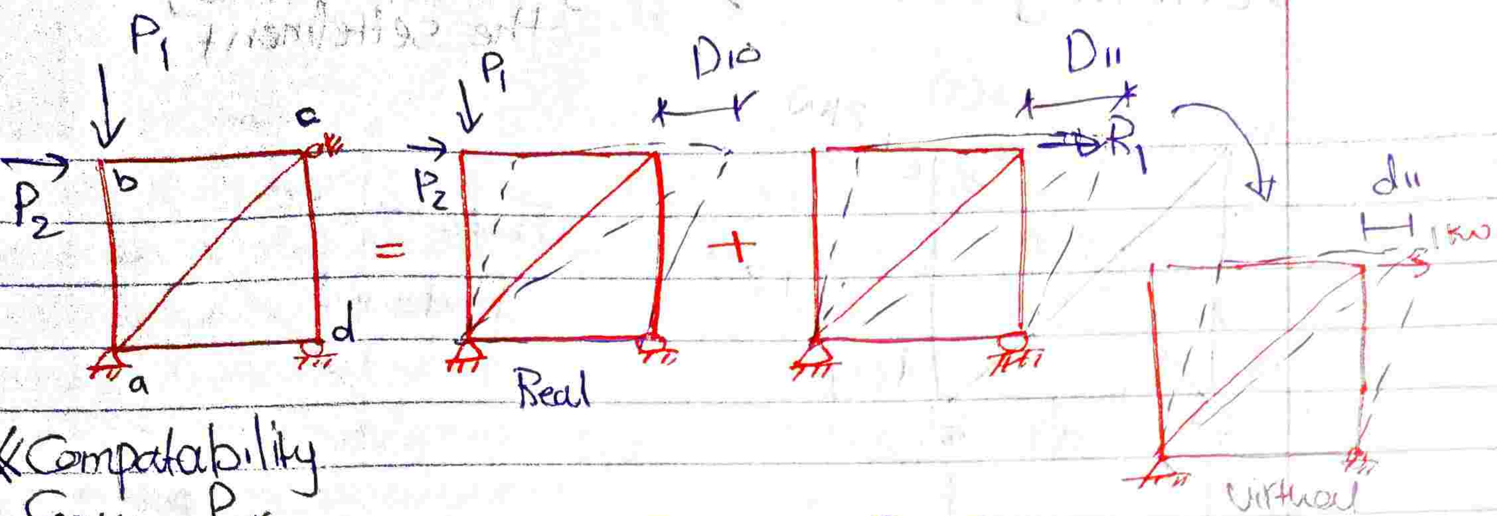
$b + r \;\; \overset{=}{\underset{>}{<}} \;\; 2j$

unknowns   # Equations

- **Example:**
  - Statically Ind. to 2nd degree
  - Internally Ind. to 1st degree
  - Externally Ind. to 1st degree



- redundent
  - ↳ member force
  - ↳ reaction force.



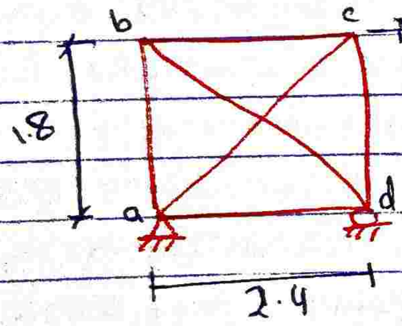
* Compatability Equ. for Horizantal displacement at C =

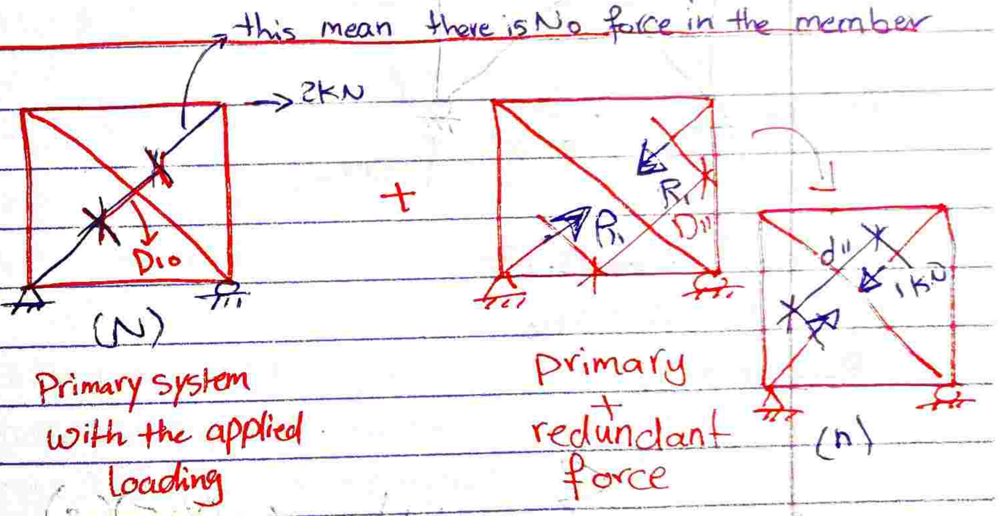
$$0 = D_{10} + R_1 d_{11}$$

$$0 = \sum n_1 \frac{NL}{EA} + R_1 \frac{\sum n_1^2 L}{EA}$$

Solve for R_1

. Example:





$R_1 = F_{ac}$

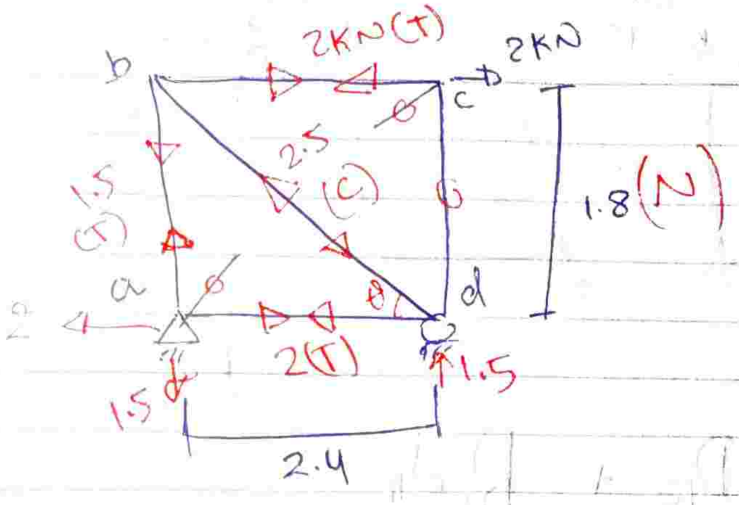
* Compatability Equ. for the relative disp at cut edges of member (ac)

$$0 = D_{10} + D_{11}$$

$$0 = D_{10} + R_1 d_{11}$$

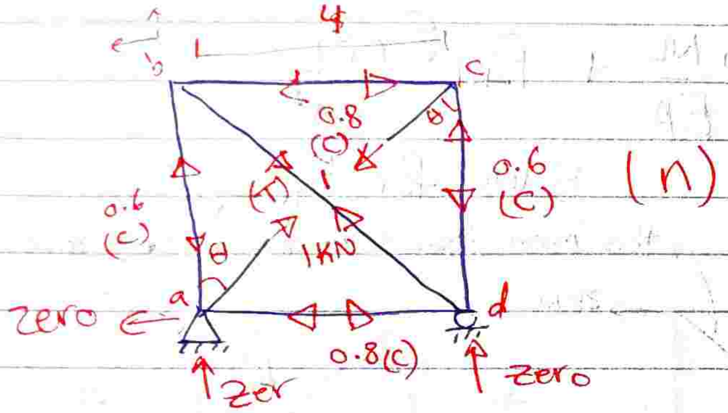
$$0 = \sum n_1 \frac{NL}{EA} + R_1 \frac{\sum n_1^2 L}{EA}$$

• Externally In dete. → only beeffected By the settelment



Fbd sinθ = 1.5

Fbd = 2.5



Cd = 1 cosθ = 0.6

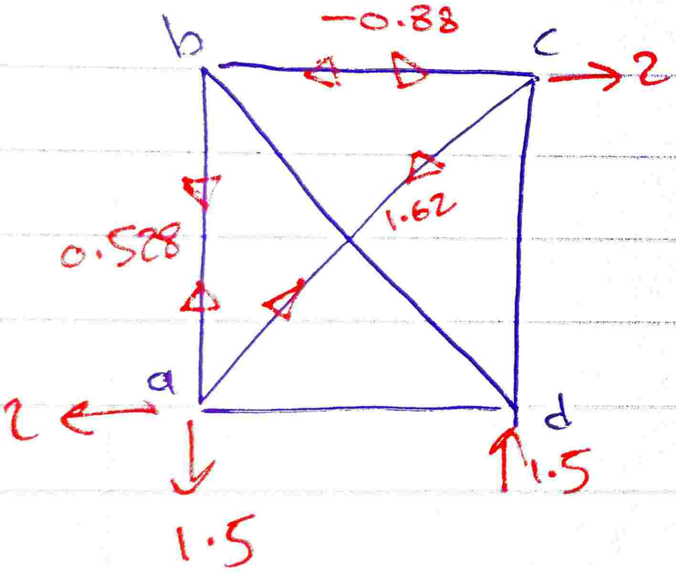
• Internal Forces. No effect on the Reactions.

$$\bullet D_{10} = \frac{\sum n_1 N L}{EA} = \frac{(-0.6)(1.5)(1.8)}{EA} + \frac{(-0.8)(2)(2.4)}{EA} + \frac{(-0.8)(2)(2.4)}{EA} + \frac{(1)(-2.5)(3)}{EA} = -\frac{16.8}{EA}$$

$$\bullet d_{11} = \frac{\sum n_1^2 L}{EA} = 2\times\left[\frac{(-0.6)^2(1.8)}{EA}\right] + 2\times\left[\frac{(-0.8)^2 * (2.4)}{EA}\right] + 2\times\left[\frac{(1)^2(3)}{EA}\right] = \frac{10.87}{EA}$$

• Apply In the Compatibility Equat. to find R_1

$$R_1 = \frac{16.8}{10.37} = 1.62 \text{ (T)}$$



$$F_m = N + R_1 n_1$$

$$F_{ab} = (N)_{ab} + R_1 (n_1)_{ab}$$

$$= (1.5) + 1.62(-0.6)$$

$$= 0.528 \text{ (T)}$$

$$F_{bd} = -2.5 + 1.62(1)$$

$$= -0.88 \text{ (C)}$$