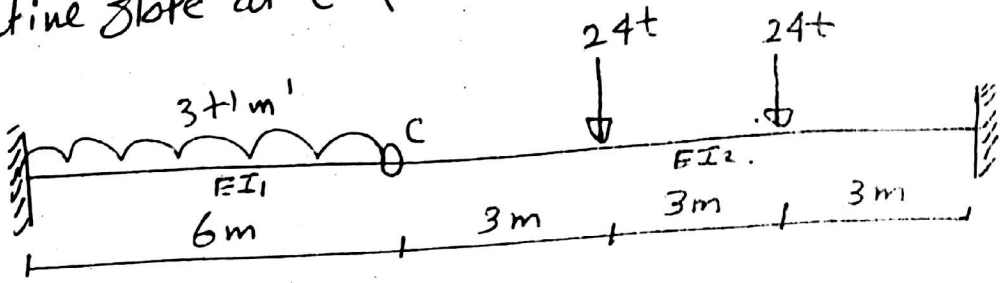
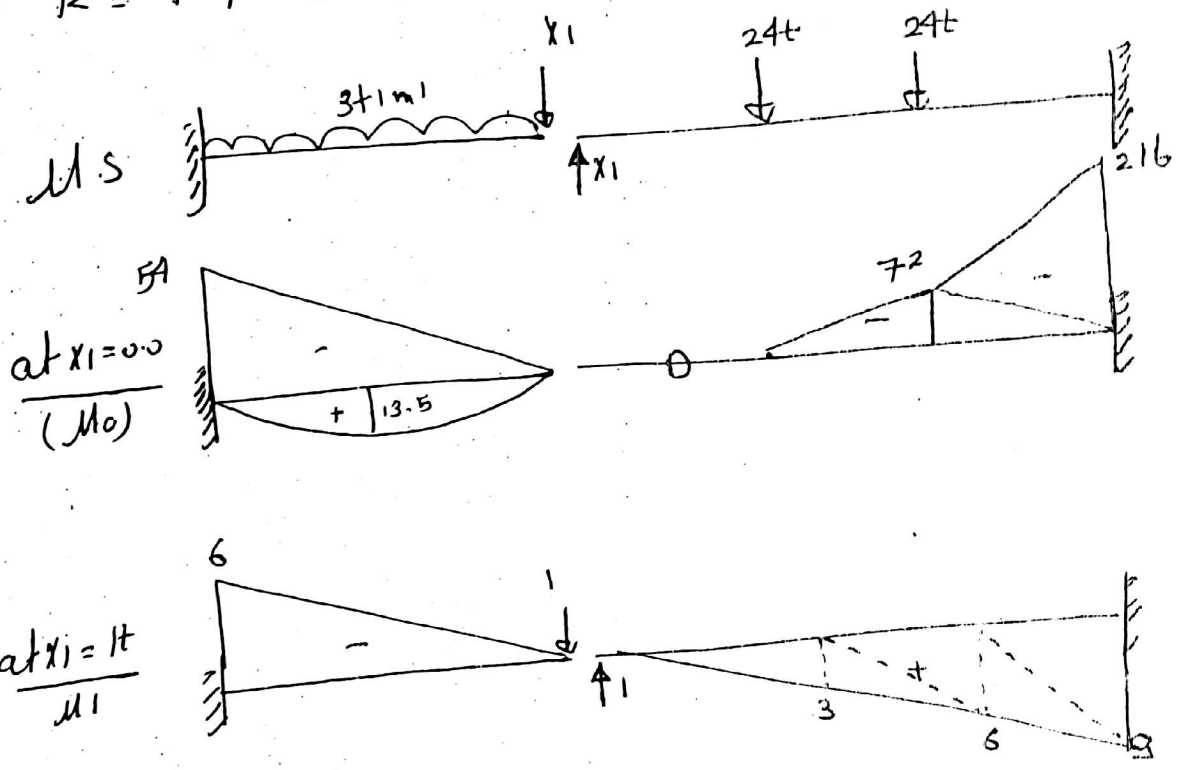
EX:1 Draw S.F.D & B.M.D, Find deflection and relative slope at C ($I_2 = 1.5I_1$), $EI_1 = 10^5\ m^2.t$



Sol

I) R = 4, C = 3, Red = 1



$$\delta_{10} = \frac{1}{EI_1}\left[\begin{matrix}(0.5*6*54*4)\\ -(2/3*6*13.5*3)\end{matrix}\right] + \frac{1}{1.5EI_1}\left[\begin{matrix}-(0.5*3*72*5)\\ -(0.5*3*72*7)\\ -(0.5*3*216*8)\end{matrix}\right]$$

$$= \frac{-2106}{EI_1}$$

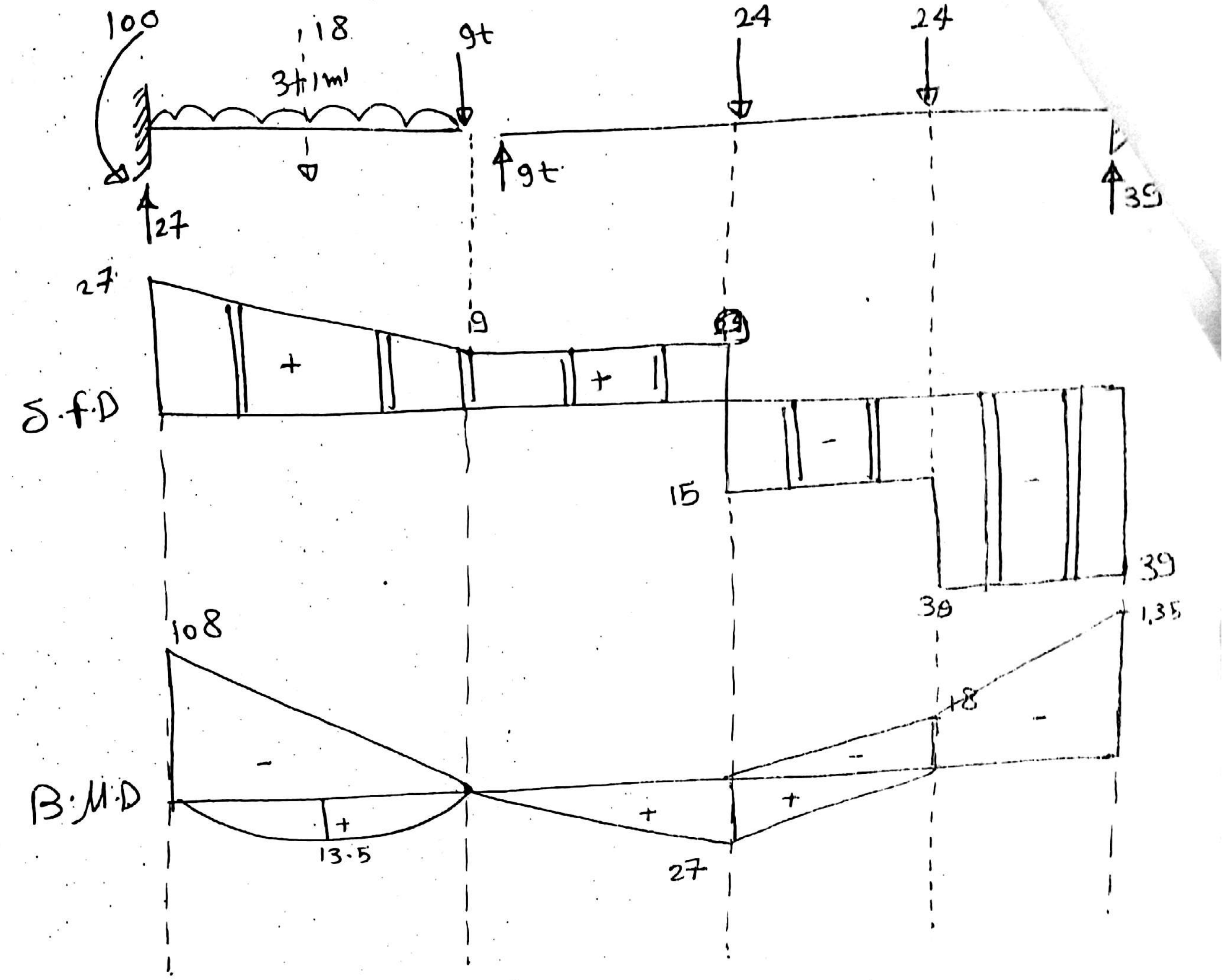
$$\delta_{11} = \frac{1}{EI_1}\left[6/3(36)\right] + \frac{1}{1.5EI_1}\left[9/3(81)\right]$$

$$= \frac{234}{EI_1}$$

$$\delta_{10} + X_1\delta_{11} = 0.0$$

$$\frac{-2106}{EI_1} + X_1\frac{234}{EI_1} = 0.0$$

get $\boxed{X_1 = 9t}$



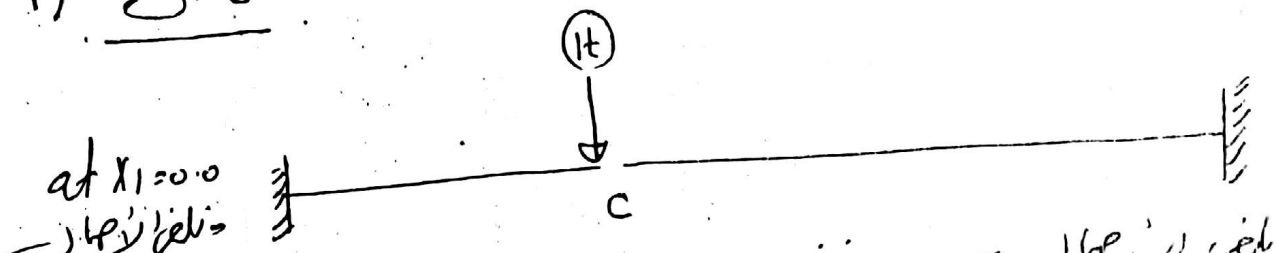
* نلاحظ أنه تم رسم الـ B.M.D بطريقة الـ SuperPosition لأنه سيتم استخدامه لحساب الـ δc . δ relc

* لحساب الـ δ عند نقطة c :

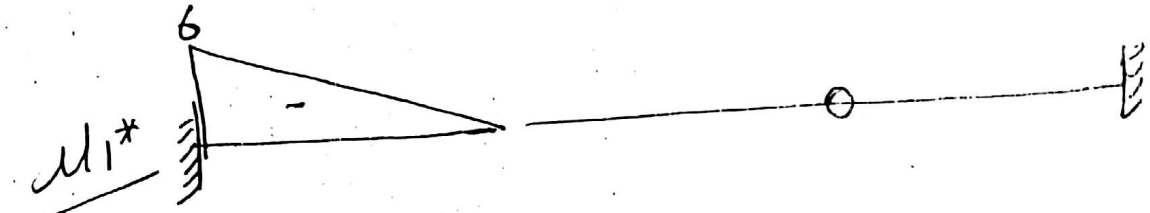
$$\delta = \frac{1}{EI} \int M_{final} \, M_1^* \, dx$$

where, M_1^* : نرسم M_1^* على الأحمال ونضع x1.0.0 ونضع حمل مقداره 1 t أو 1 t.m حسب الحركة المطلوبة. ويتم رسم الـ BMD نتيجة لهذا الحمل ثم نكاملها مع M_{final} للحصول على (δ).

1) δ_{v1c}:



نلغي الحمل ونضع X1=0.0 ونضع حمل وهمي
1t عند النقطة (C). ونرسم (M_1^*)



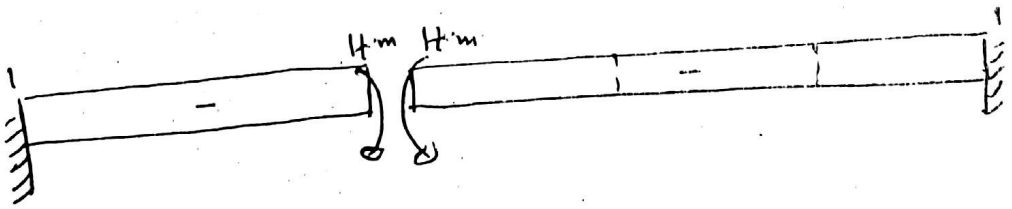
$\frac{M_1^*}{\delta_{v1c}}$

$$\delta_{v1c} = \frac{1}{EI1}\left[\begin{matrix}(0.5*6*108*4)\\ -(2/3*6*13.5*3)\end{matrix}\right]$$

$$= \frac{1134}{EI1} = \frac{1134}{10^5} = 0.01134m = \boxed{1.134Cm}$$

2) α_{relc}: M_1^* نلغي الحمل ونرسم

ونضع X1=0.0



$\frac{M_1^*}{\alpha_{relc}}$

$$\alpha_{relc} = 1/EI1\left[\begin{matrix}(0.5*6*108*1)\\ -(2/3*6*13.5*1)\end{matrix}\right]$$

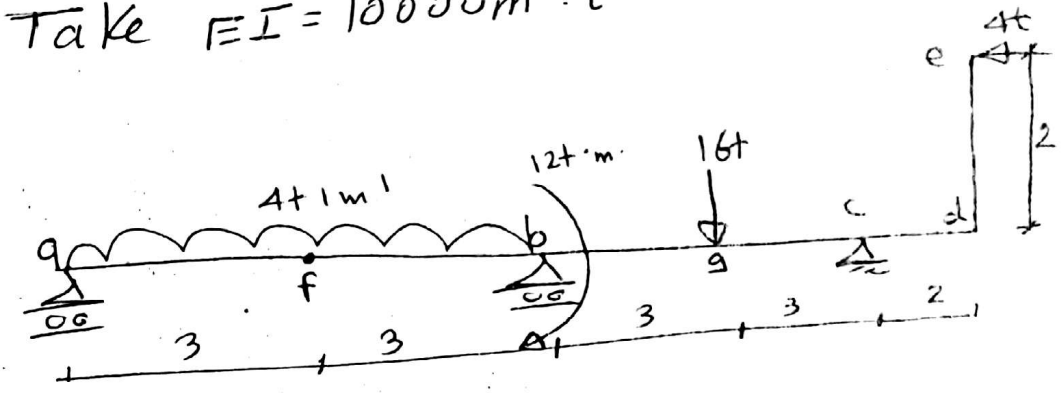
$$+\frac{1}{1.5EI1}\left[\begin{matrix}-(0.5*3*27*1)+(0.5*3*18*1)\\ -(0.5*3*27*1)+\left(1*3*\left(\frac{18+35}{2}\right)\right)\end{matrix}\right] = \frac{387}{EI1}$$

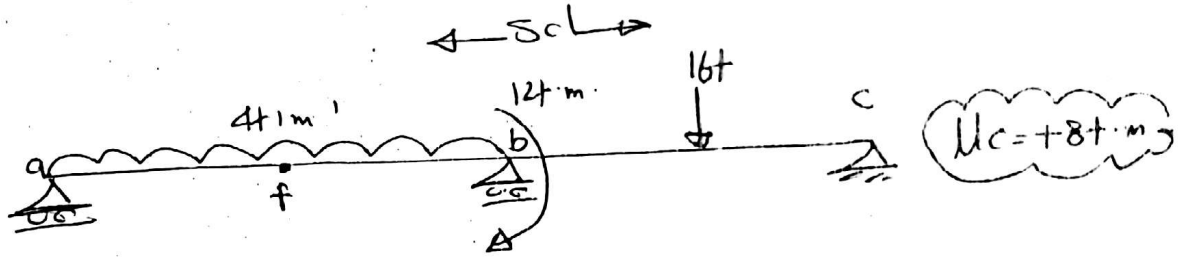
$= 0.00387$ rad

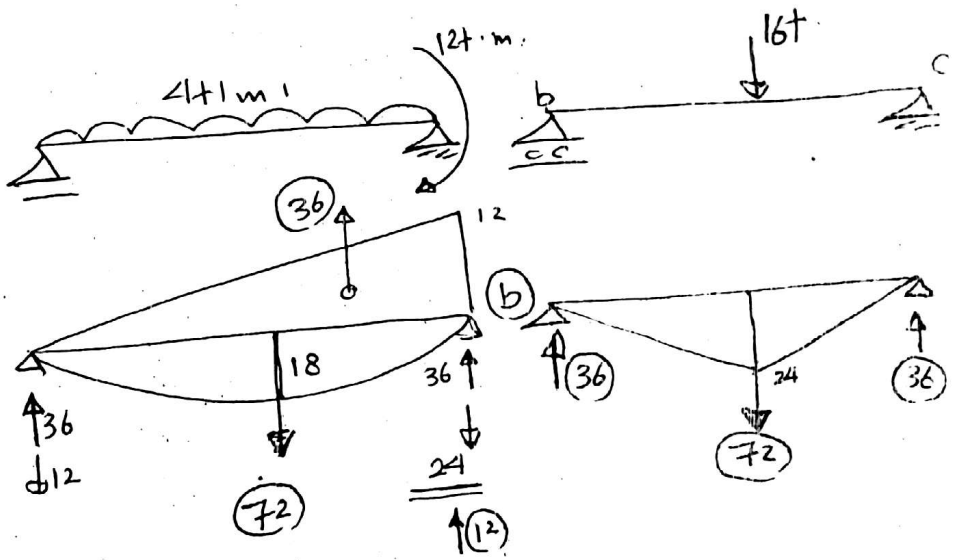
(A)

EX:1 using 3 Mom :: Draw B.M.D & S.F.D then Compute The vertical deflections at Points f, g, d & horizontal displacement at e

Take $EI = 10000 m^2 \cdot t$



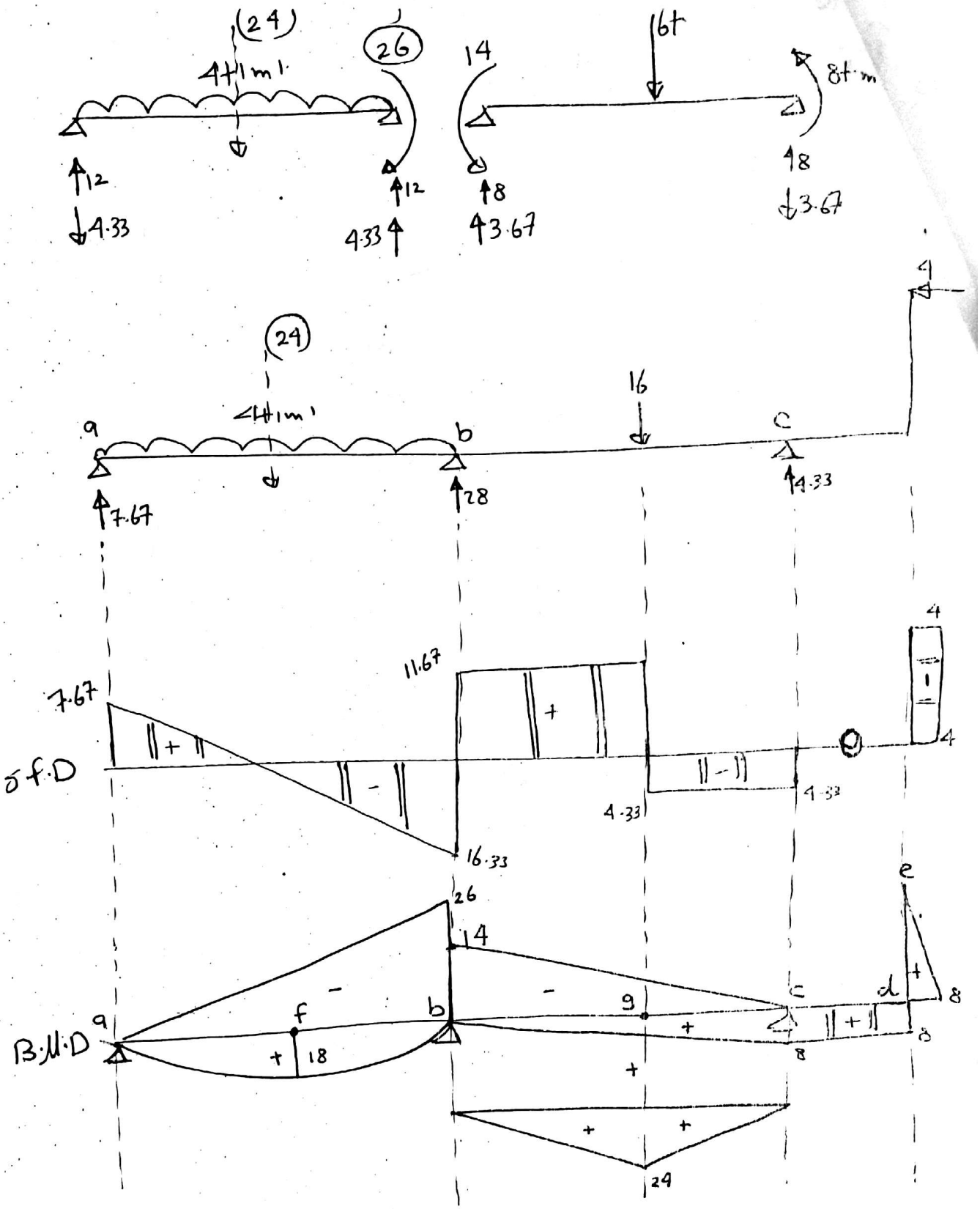




3 Mom at (b) ::

$$0.0 + 2Mb(6+6) + 8(6) = -6[12+36]$$

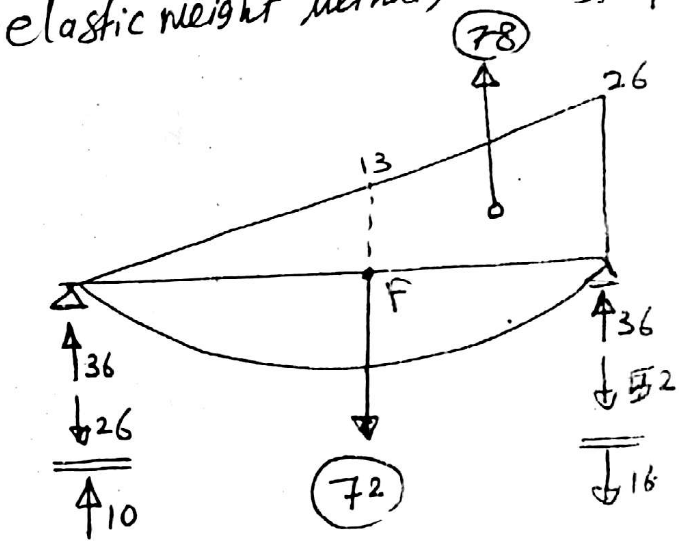
$$\therefore Mb = -14 t \cdot m$$



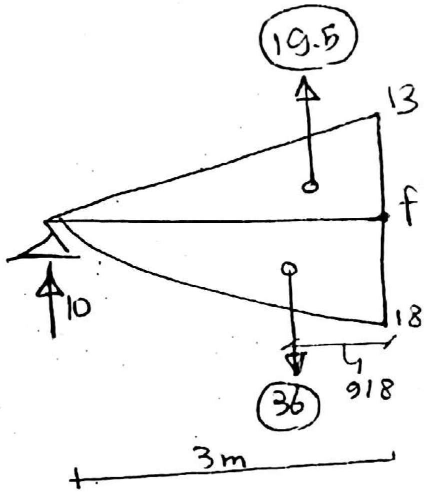
(6

ال في عندك الفتحة و الهنه بطريقة سوف
نستخدم ال (elastic weight Method)

Beam ab:



δ at Point (f)

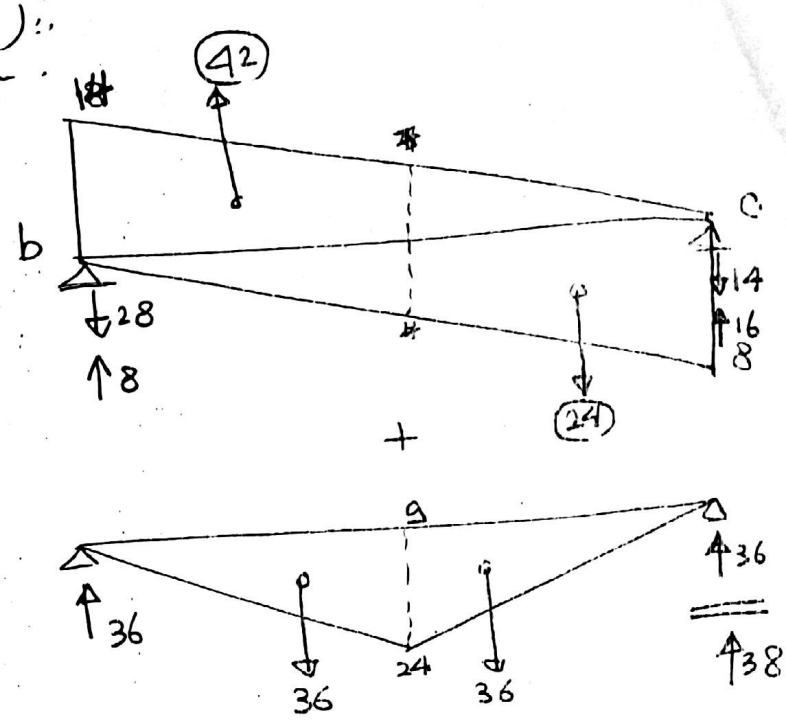


$$\delta f = \frac{10 * 3 + 19.5 * 1 - 36 * 918}{EI} = \frac{9}{EI} = \frac{9}{10000} * 100 = 0.09 \text{ cm}$$

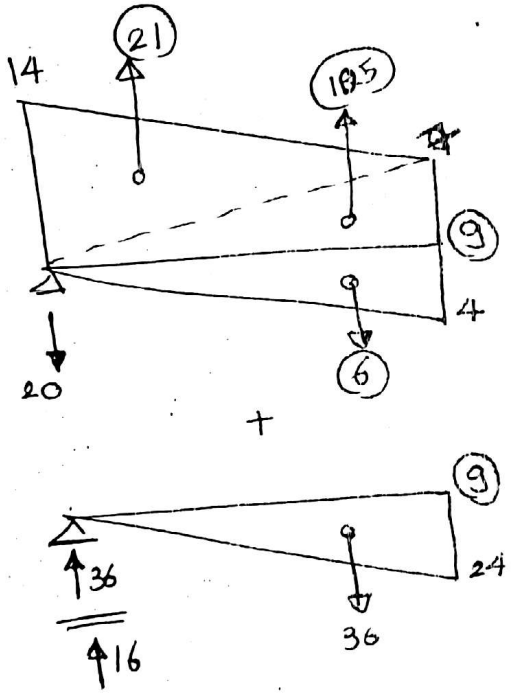
نحولها لل cm

at Point (9) :-

→ Beam (bc) :-



For left Part :-

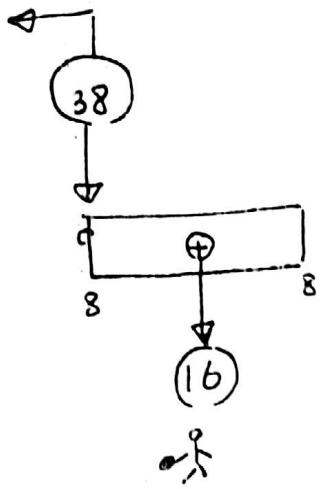


$$\delta_9 = \frac{1}{EI}\left[16*3 + 21*2 + 10.5*1 - 6*1 - 36*1\right]$$

$$= \frac{58.5}{EI} = 0.585\ \text{Cm} \downarrow$$

at Point d //e:

((Reaction From Simple))
(bc)

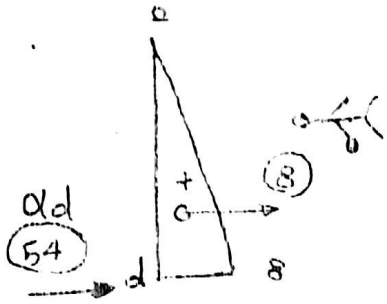


$$\therefore \delta d = \frac{-16*1 - 38*2}{EI} = \frac{-92}{EI} = \boxed{-0.92\ Cm}$$

* To get horizontal displacement ate:

بلزم اوجد إيجاد الـ Rotation عند d لكي نتمكن من إيجاد الجذر (de) لحل

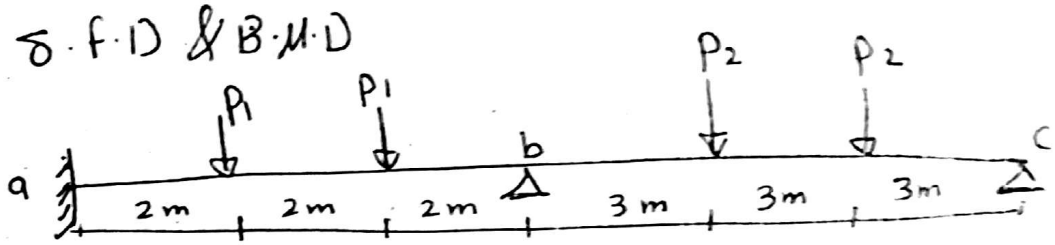
$$\alpha d = \frac{-38-16}{EI} = \boxed{\frac{-54}{EI}}$$

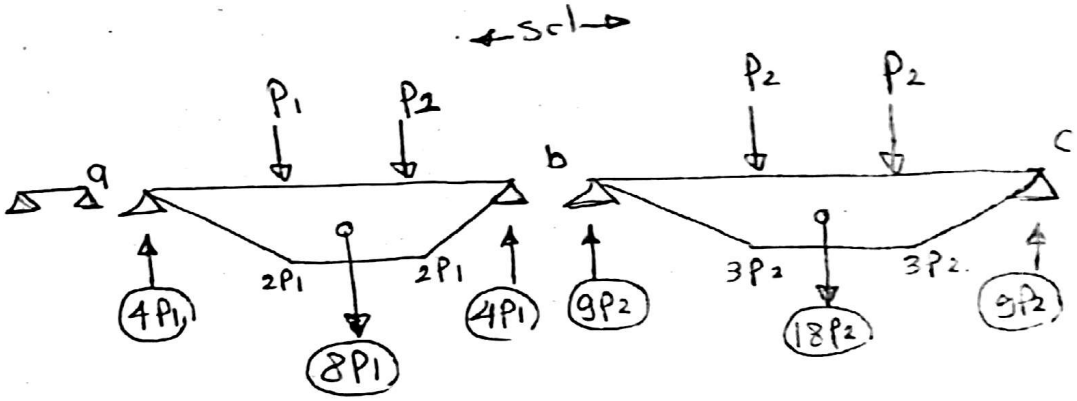


$$\therefore \delta h_e = 1/EI \left[-54*2 - 8*1.33 \right]$$

$$= \frac{-118.67}{EI} = \boxed{-1.1867\ Cm} \leftarrow$$

EX: Find The Magnitude of P_1 & P_2 Such The $M_a = M_b$ in Magnitude and Sign and The Max^{+ve} B.M in Span bc equal 16 t.m, Then Draw S.F.D & B.M.D





3. Mequata:

$$0.0 + 2M_a(0+6) + M_b(6) = -6[0.0 + 4P_1]$$

$$12M_a + 6M_b = -24P_1$$

but $M_a = M_b$

$$\therefore 18M_a = -24P_1$$

$$\therefore M_a = -1.33P_1 \rightarrow (1)$$

3. Moment at b:

$$M_a(6) + 2M_b(6+9) + 0.0 = -6[4P_1 + 9P_2]$$

($M_b = M_a$)

$$36M_a = -24P_1 - 54P_2$$

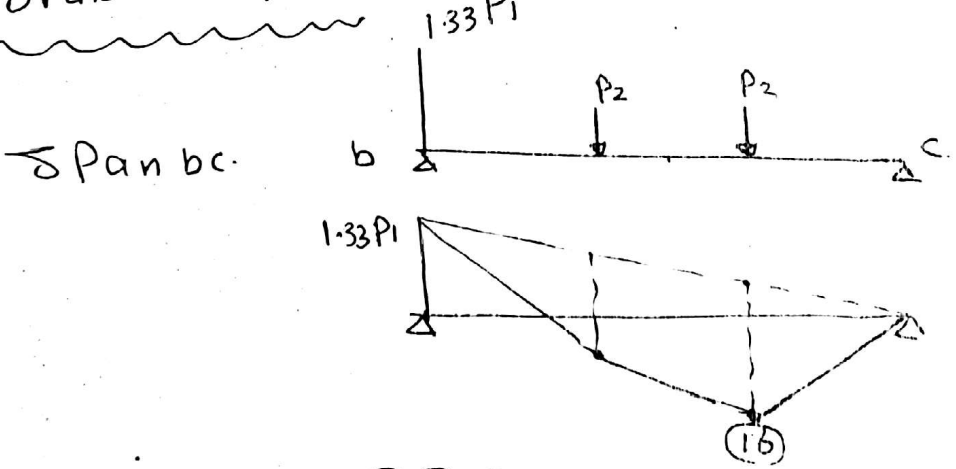
but $M_a = -1.33P_1$ from equ (1)

$$\therefore 36(-1.33P_1) = -24P_1 - 54P_2$$

$$-24P_1 = -54P_2$$

$$\therefore P_1 = 2.25P_2 \quad \text{---} (2)$$

* Max^{+ve} B.M in span bc = +16 t·m



$$\text{Max}^{+ve}\ B.M = 16 = 3P_2 - \frac{1.33P_1}{3} \quad \text{---} (3)$$

(3) ⟵ (2)

$$16 = 3P_2 - \frac{1.33(2.25P_2)}{3} = 3P_2 - P_2$$

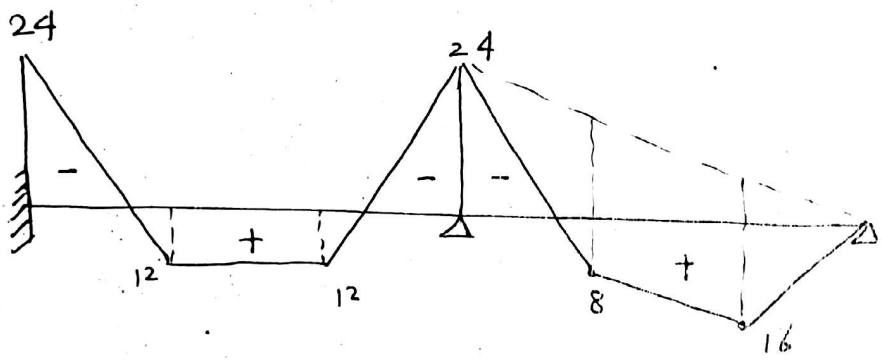
$$\therefore 2P_2 = 16$$

$$\therefore P_2 = 8t$$

$$\therefore P_1 = 2.25P_2 = 2.25 * 8 = 18t$$

$$\therefore Ma = Mb = -1.33 * 18 = -24t\cdot m$$

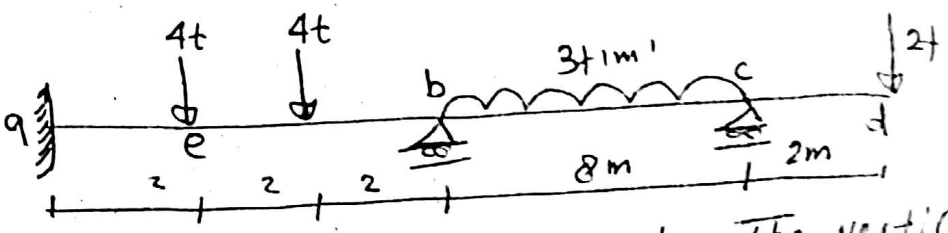
B.M.D



(12

H.W :.

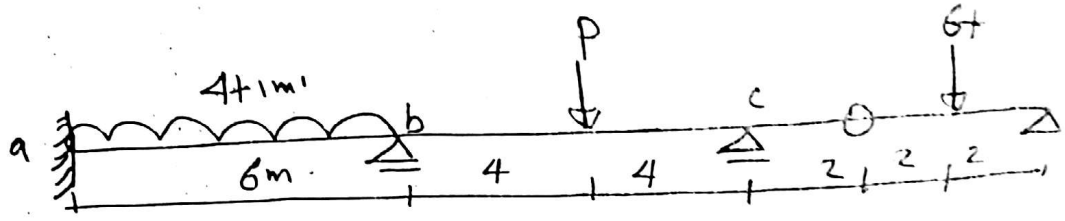
1)



* Draw S.f.D & B.M.D , Find also The vertical deflection at Point d,e by 1) Consistent deformation.

2) 3 Mequ

2)



. (using 3 Mequ)

1) if P = 6t Draw S.f.D & B.M.D.

2) Find P such That negative moment at b is equal max+ve moment in span bc in magnitude.