

# سلسله العبدین الحسینین

قید آ. م.  $t_1$

رقم  
(۱۱)

ملف  
۲۵  
استراش  
۲۴

Str (2)  
۲ مدنی

## مراجعة Super Position Part (I)

الحادیه  
عشر  
2010

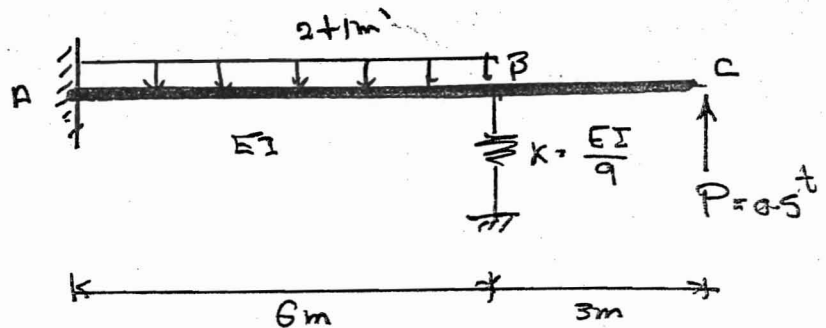
Example	Year	Page
(1)	Jun (1995)	(1, 2)
(2)	Jun (1996)	(3, 4)
(3)	Nov (1997)	(4 → 6)
(4)	Nov (1998)	(6, 7)
(5)	Nov (1999)	(8, 9)
(6)	Jan (2001, 2005)	(9, 10)
(7)	Jun (2002)	(11, 12)
(8)	Nov (2003)	(12 → 14)
(9)	Nov (2005)	(15, 16)

(P) ارسم (B.M.D & SFD) ثم

احسب التخم عند نقطة (C)

(B) احسب قيمة (P) بحيث يكون

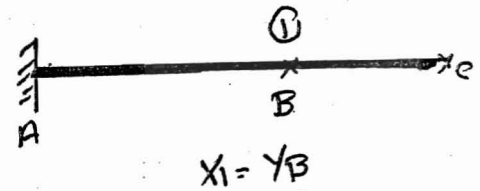
التخم عند (C) صفر.



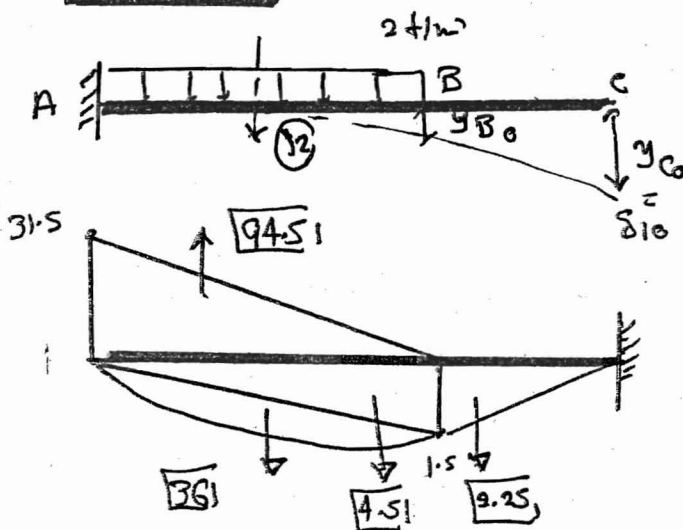
(1) Degree

$$D = 3 - 2 = 1$$

(2) M.S



(3) Load (0)

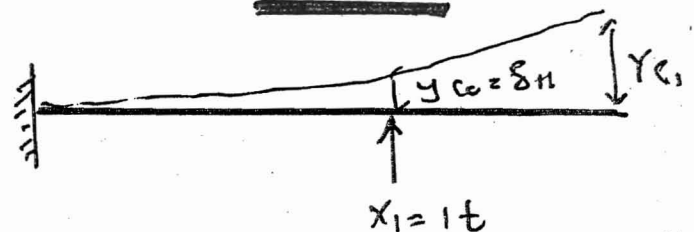


$$\delta_{10} = y_{B0} = \frac{261}{EI} \text{ m}$$

$$\delta_{10} = \frac{418.5}{EI} \text{ m}$$

تخمين  
القطر  
النقطة

(4) Load (1)



$$\delta_{11} = y_{B1} = \frac{-72}{EI} \text{ m}$$

$$\delta_{11} = \frac{-126}{EI} \text{ m}$$

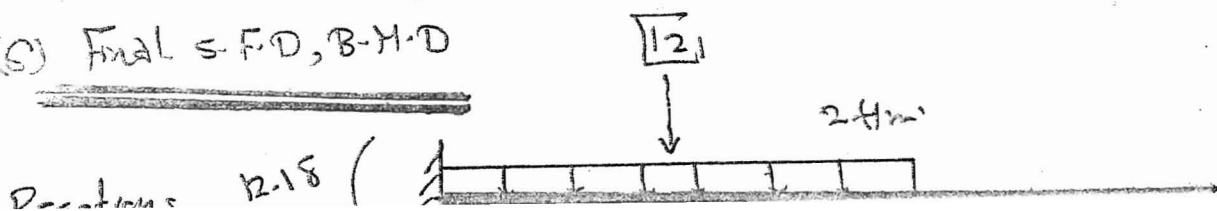
تخمين  
القطر  
النقطة

(5) Condition at (B)  $\delta_{10} + \delta_{11} x_1 = \frac{x_1}{K}$

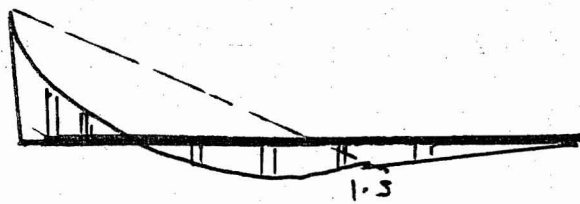
$$\frac{261}{EI} + \frac{-72}{EI} (x_1) = \frac{x_1}{EI}$$

$$x_1 = y_B = 3.22 \text{ t}$$

(6) Final S.F.D, B.M.D

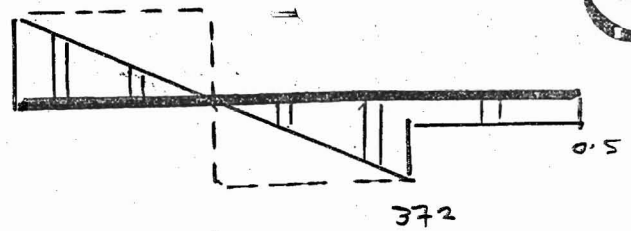


12.18



(B.M.D)

8.28



(S.F.D)

(c) انحراف عند (c)  $y_c = y_G + x_1 y_{c1}$   $\therefore y_c = \frac{418.5}{EI} + 3.32 \times \frac{-126}{EI}$

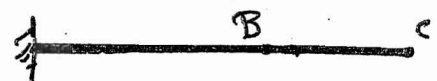
$y_c = 12.503/EI \text{ m}$

مسألة جديدة

(P) التي تقع انحراف عند (c) = صفر

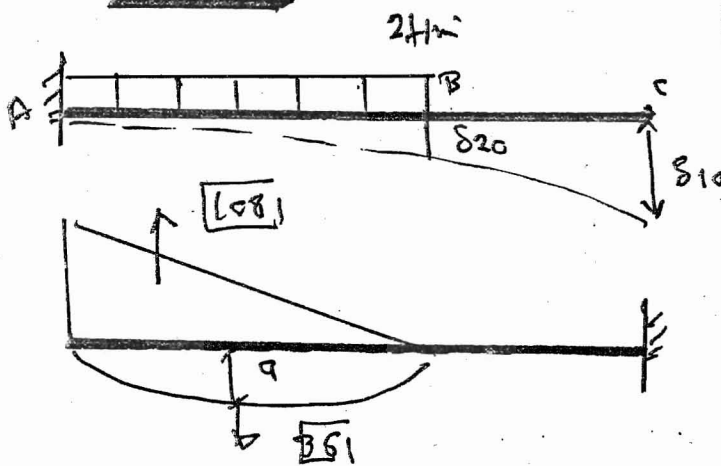
(1) Degree  $D=2$   $\begin{matrix} y_c \\ y_B \end{matrix}$

(2) M.S



$x_2 = y_B$   $x_1 = y_c = P$

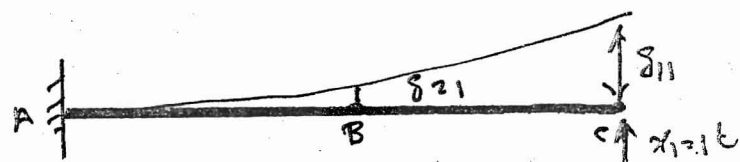
(3) Load (1)



$\delta_{10} = \frac{540}{EI}$

$\delta_{20} = \frac{324}{EI}$

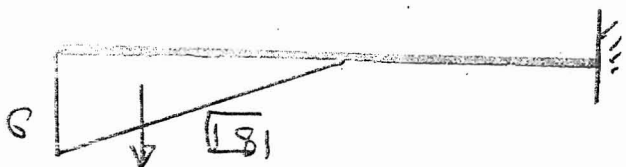
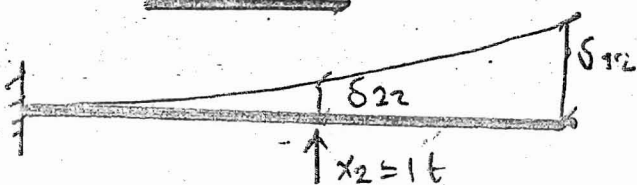
(4) Load (1)



$\delta_{11} = -\frac{243}{EI}$

$\delta_{21} = \frac{-126}{EI}$

(5) Load (2)



(6) Condition

$\delta_{10} + \delta_{11} x_1 + \delta_{12} x_2 = 0$  (c)  $\rightarrow$  (1)

$\delta_{20} + \delta_{21} x_1 + \delta_{22} x_2 = \frac{x_2}{k}$   $\rightarrow$  (2)

بجد المعادلتين (1) و (2) نحصل على

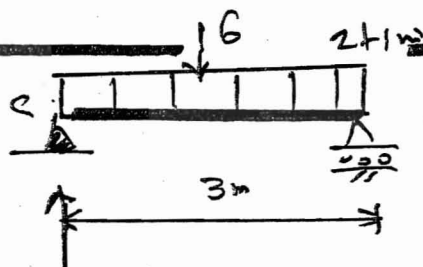
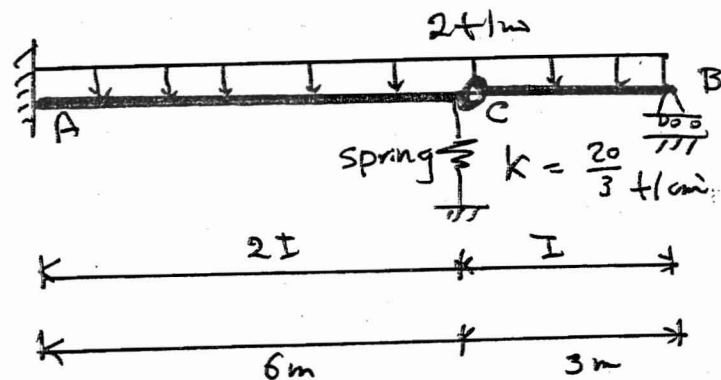
$x_1 = P = 0.766 \text{ k}$   $x_2 = 2.8 \text{ k} = y_c$

\* باستخدام طريقة التحجيج اصيب (٧٠) وارسم (SFD) و (BMD)

\*  $EI = 6000 \text{ t.m}^2$

\*  $k = \frac{20}{3} \text{ t/m}$

$= \frac{20}{3} \times 100 \text{ t/m}$

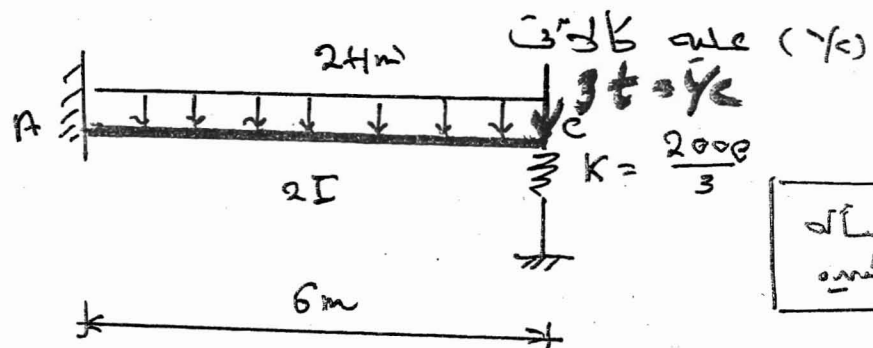


$Y_c = 3t$   
(A) على

(1) Degree  $D=1$

\* بالتحليل عند نقطة (C) يصبح الجرس (B) حرة

\* سيتم حل المسألة الغير محدودة بعد اعتبار الفقد



المسألة  
المعقدة

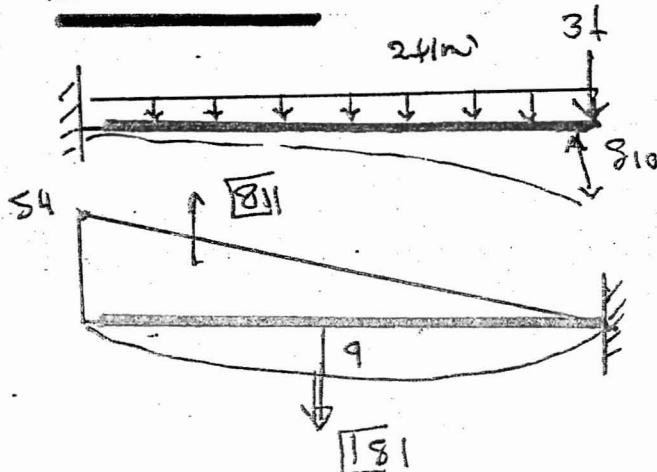
(2) M.S'



$X_1 = Y_c$

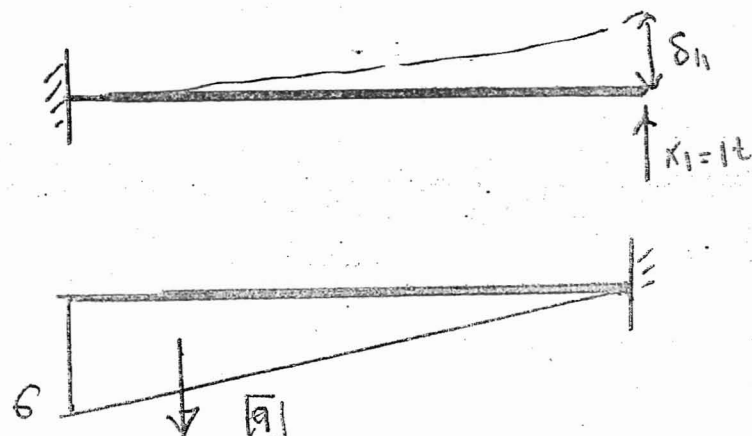
حرة وحصل  
الزبرك عند (C)

(3) Load (0)



\*  $\delta_{10} = \frac{270}{EI} \text{ m}$

(4) Load (1)



\*  $\delta_{11} = \frac{-36}{EI} \text{ m}$

(5) Condition at (c)  $\delta_{10} + \delta_{11} x_1 = y_c = \frac{x_1}{K} \sim \frac{2000}{3}$  4

$\therefore \frac{270}{6000} - \frac{36}{6000} x_1 = \frac{3x_1}{2000} \quad \therefore 15x_1 = 90 \quad \therefore x_1 = y_c = 6t$

(6) Final S.F.D, B.M.D

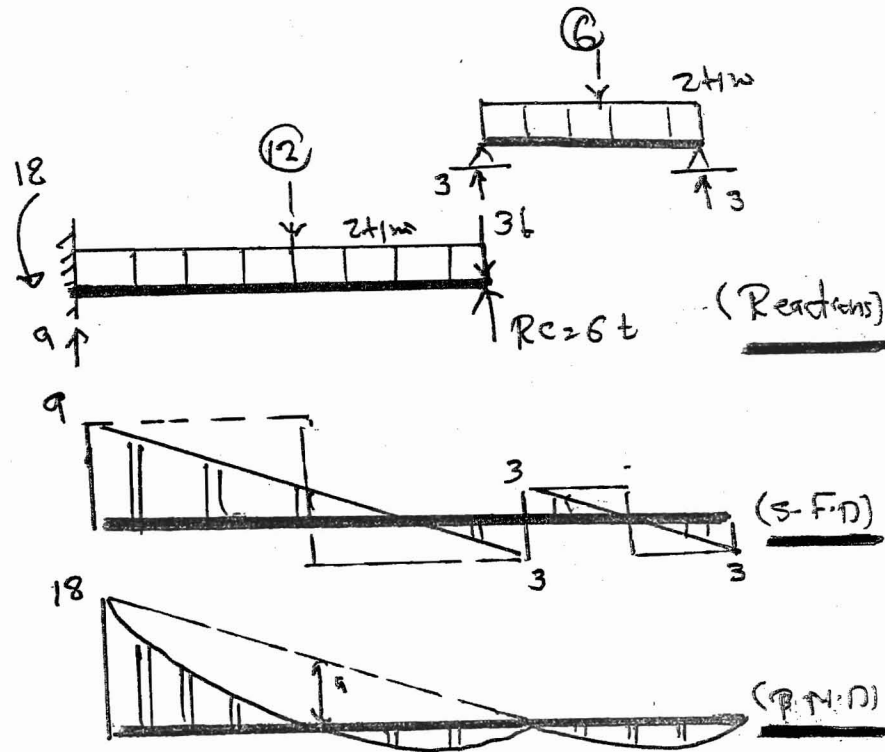
\* احسب (y<sub>c</sub>) مساوي

مقدار الانحناء في

الزبرك  $y_c = \frac{x_1}{K}$

$\therefore y_c = \frac{6}{2000/3}$

$y_c = \frac{18}{2000} m$



م.ت 2007  
جامعة

EX(3) NOV(1997)

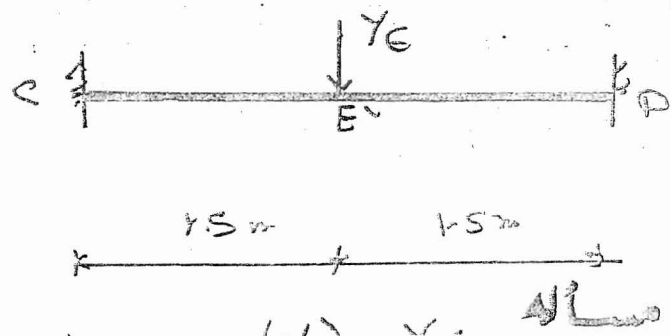
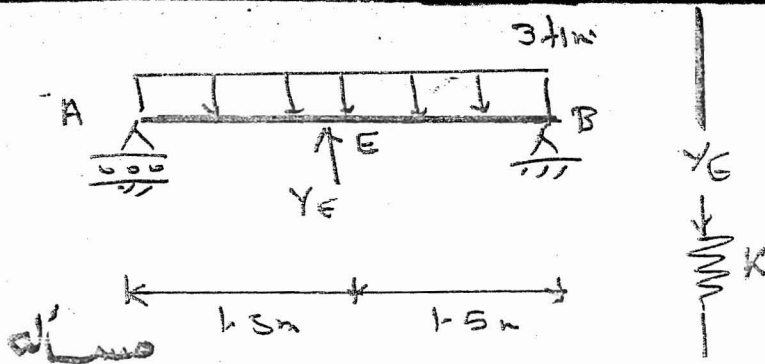
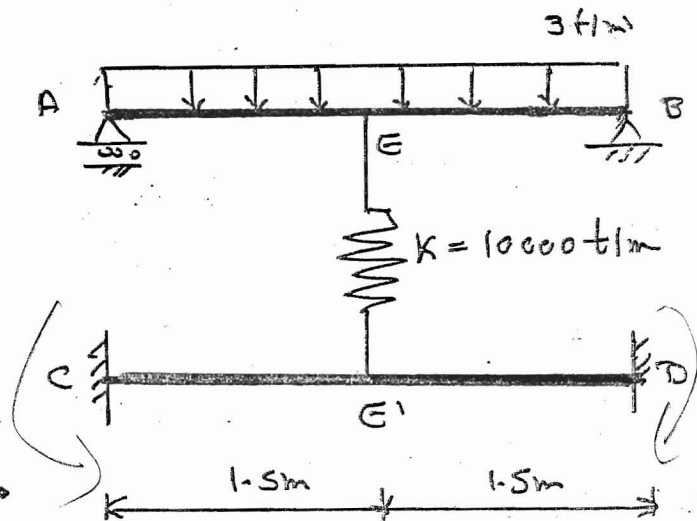
\* باستخدام طريقة القويح لرسم لقل

من الكمرتين (AB) و (CD) الـ

(B.M.D) و (S.F.D)

\* معلوم صيف  $EI = 10000 t \cdot m^2$

\* تخيل كميات متصلة غير زبرك

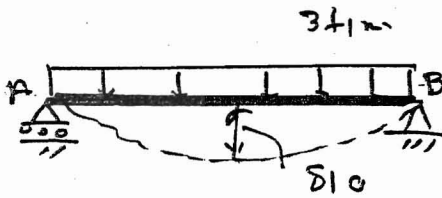


# مسألة (1) Beam (AB)

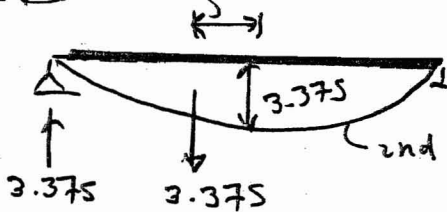
•  $D = 1$

•  $X_1 = Y_c$

• Load (0)

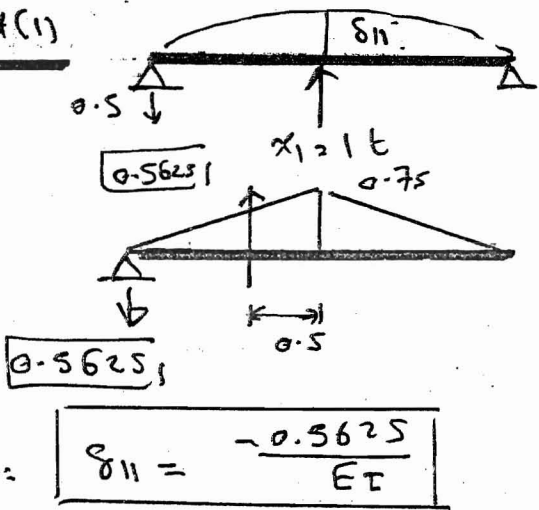


$\frac{3}{8}(L) = 0.5625$



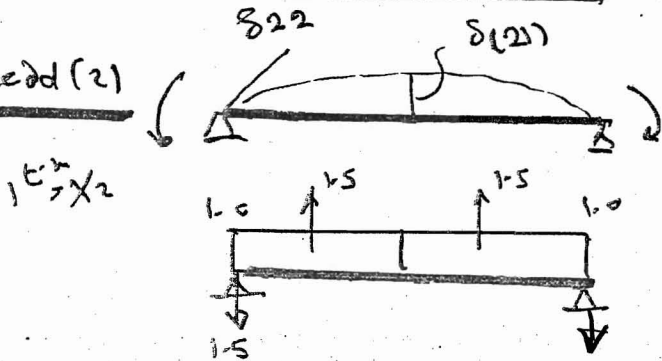
$\delta_{10} = 3.164 / EI$

• Load (1)



$\delta_{11} = \frac{-0.5625}{EI}$

• Load (2)



$\delta_{11} = 0.5625 / EI$   
 $\delta_{12} = 0.5625 / EI$

$\delta_{21} = \frac{-1.125}{EI}$   
 $\delta_{22} = -1.5 / EI$

Condition at (c)  $\delta_{20} + X_1 \delta_{21} + X_2 \delta_{22} = 0.0$   
 $0.0 + \frac{0.5625}{EI} X_1 + \frac{-1.5}{EI} X_2 = 0.0$   
 $X_1 = 2.67 X_2$

at (E)  $\delta_{10} + \delta_{11} X_1 = (\delta_{10} + X_1 \delta_{11} + X_2 \delta_{12}) + \frac{X_1}{K}$

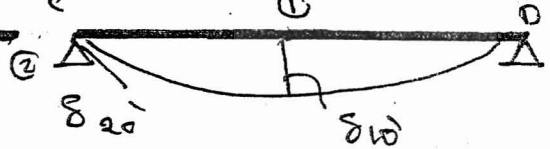
# مسألة (2) Beam (CD)

5

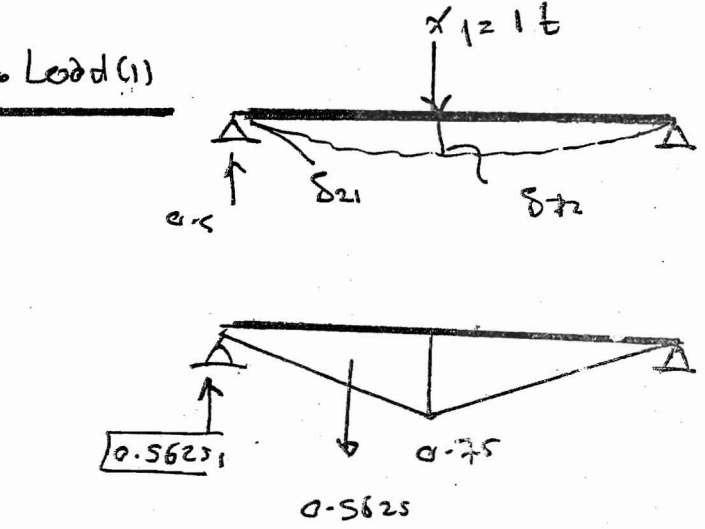
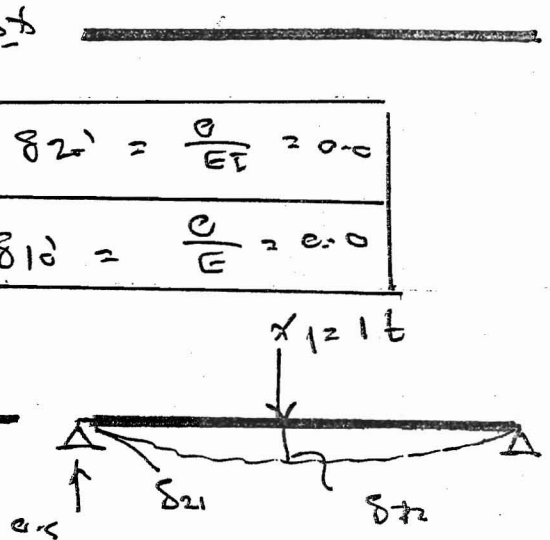
•  $D = 2$

•  $X_1 = Y_c$   
•  $X_2 = M_c = M_D$

• Load (0)



• Load (1)



$\delta_{11} = 0.5625 / EI$   
 $\delta_{12} = 0.5625 / EI$

$\delta_{21} = \frac{-1.125}{EI}$   
 $\delta_{22} = -1.5 / EI$

Condition at (c)  $\delta_{20} + X_1 \delta_{21} + X_2 \delta_{22} = 0.0$   
 $0.0 + \frac{0.5625}{EI} X_1 + \frac{-1.5}{EI} X_2 = 0.0$   
 $X_1 = 2.67 X_2$

at (E)  $\delta_{10} + \delta_{11} X_1 = (\delta_{10} + X_1 \delta_{11} + X_2 \delta_{12}) + \frac{X_1}{K}$

$$\frac{3.164}{10000} - \frac{0.5625}{10000} X_1 = 0 + \frac{0.5625}{10000} X_1 - \frac{1.125}{10000} X_2 + \frac{X_1}{10000} \rightarrow (2)$$

6

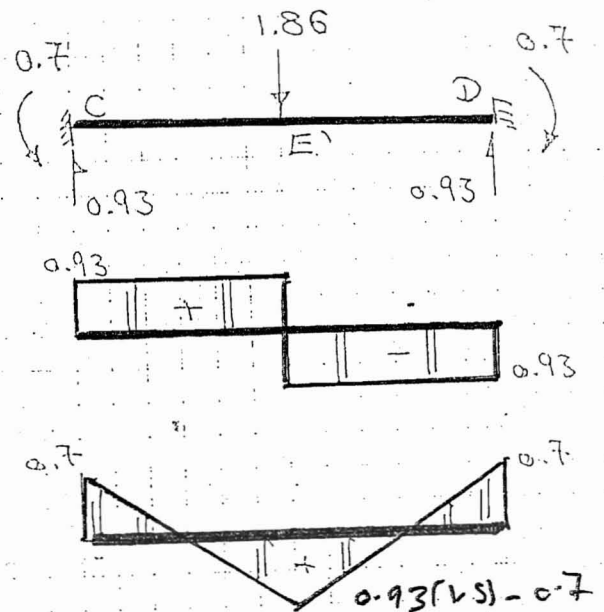
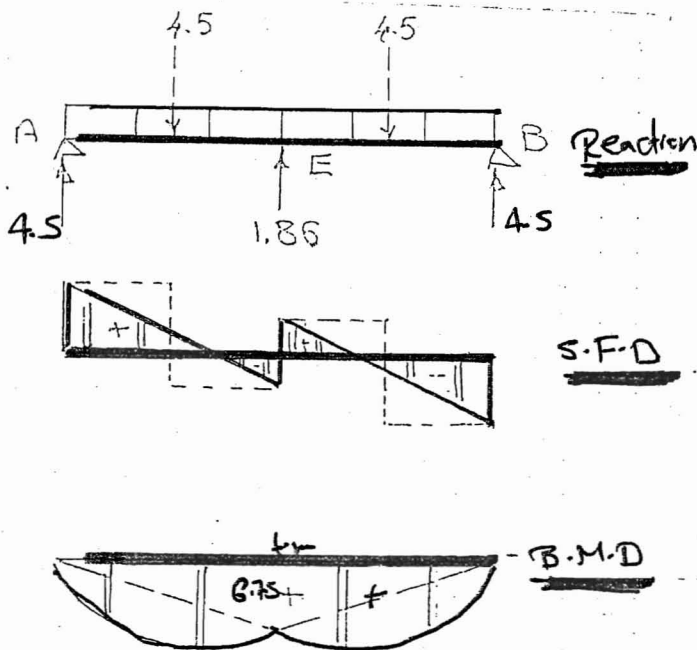
حل (1) و (2)  
نحصل على

$$X_1 = Y_G = 1.86 \text{ t}$$

$$X_2 = M_C = M_D = 0.7 \text{ t.m}$$

نرسم كل كمر على حده

(Final S.F.D, B.M.D)



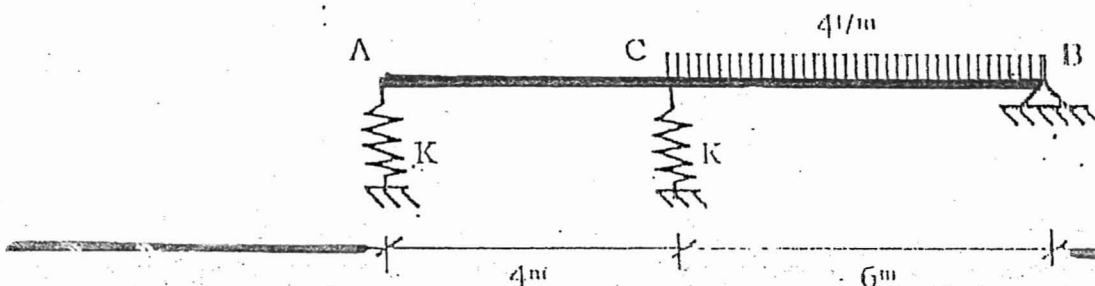
## EX(4) Nov(1998)

لكثرة المبينة بشكل (1) ارسم أشكال قوى القص وعزم الانحناء نتيجة للأحمال المبينة علما بأن :

For the Beam AB,  $EI = 10000 \text{ tm}^2$

For the springs at A & C,  $K = 10 \text{ t/cm}$

✓



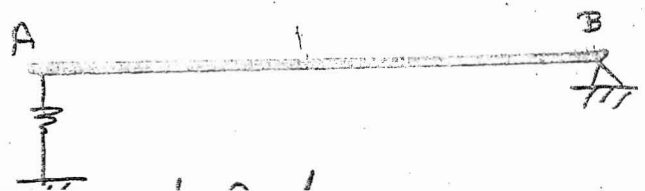
(1) Degree of D = 3 - 2 = 1

(2)  $M \neq X_1 = Y_C$

الفرد / دخذ  
البركة (1)

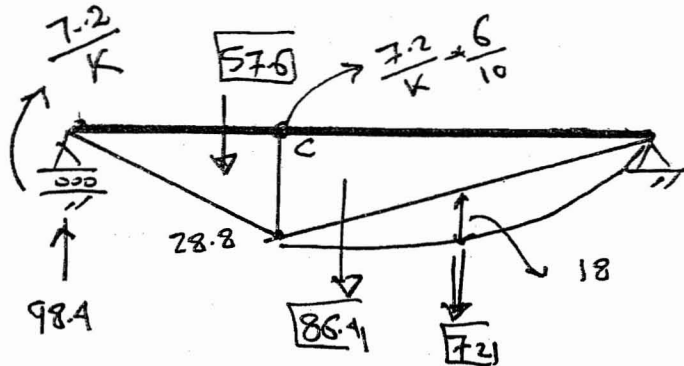
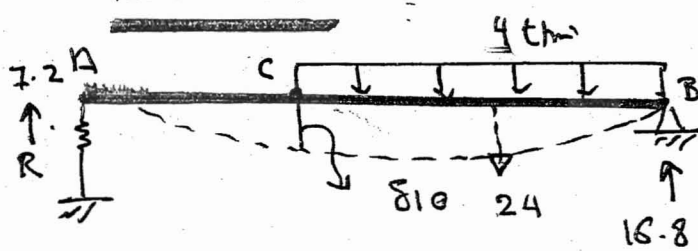
لاحظ أن اللوح المرافقة للحدود

(A) البركة البركة يكون





(3) Load (0)

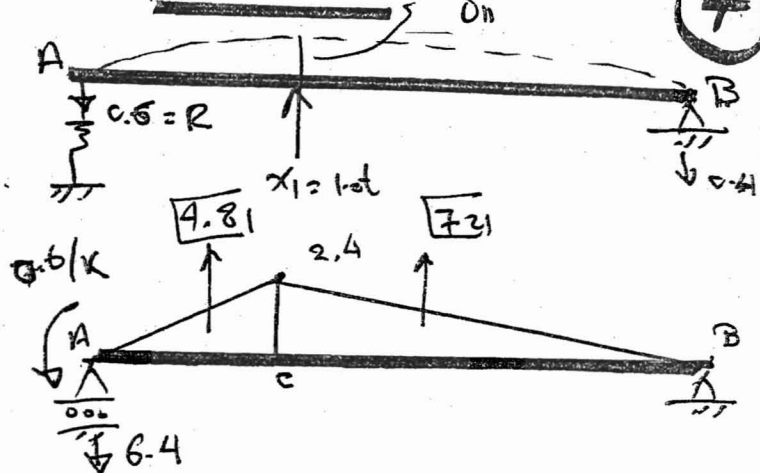


$$\delta_{10} = \frac{98.4(4) - 57.6(\frac{4}{3})}{EI}$$

اضاف الى spring  
 $+ \frac{7.2}{K} (\frac{6}{10})$  فيه حايكون عند (c)

$$\delta_{10} = \frac{360}{EI}$$

(4) Load (1)



$$\frac{0.6}{K} = \frac{0.6}{K} \times \frac{6}{10}$$

$$\delta_{11} = \frac{-0.6(6)}{10K} + \frac{-6.4(4) + 4.8(\frac{4}{3})}{EI}$$

فيه حايكون عند (c)

$$\delta_{11} = \frac{-22.8}{EI}$$

(5) Condition

$$\delta_{10} + x_1 \delta_{11} = \frac{x_1}{K} \quad \therefore \frac{360}{EI} - \frac{22.8}{EI} x_1 = \frac{x_1}{K}$$

$$\therefore x_1 = 10.796$$

$$\therefore Y_C = 10.97 t$$

(6) Final S.F.D, B.M.D

عند وجود Spring

في (M.S) يكون

هناك هبوط

اثنائي حادث

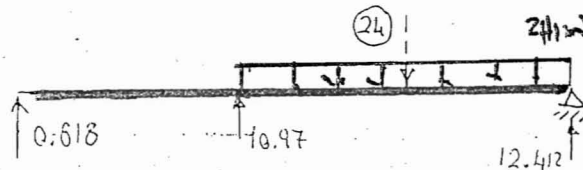
عند النقطة بالأسفل

طوبى الاعمال

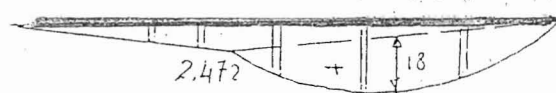
ختمه =

من النقطة  $\frac{R}{K}$

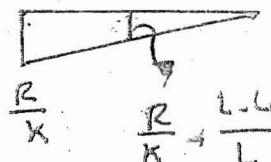
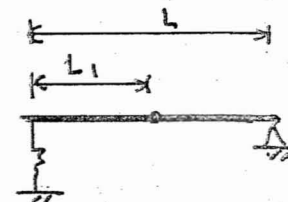
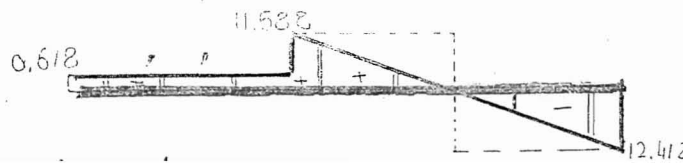
Reaction



B.M.D



S.F.D







(Condition)

9

$$\delta_{10} + x_1 \delta_{11} = y_B$$

$$\frac{1062}{EI} - \frac{72}{EI} x_1 = 0.01$$

19800

$$\therefore x_1 = y_B = 12 \text{ t}$$

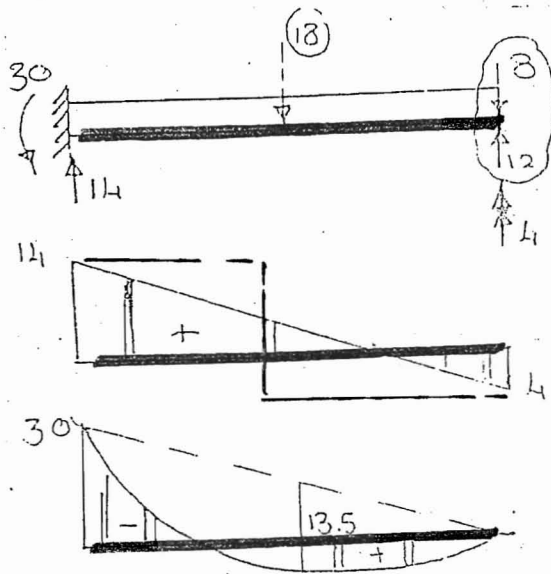
لصاف (K) حبابه المرنين

$$\delta_{10}^* + x_1 \delta_{11}^* = y_B^* \cdot 0.01$$

$$0 + \left( \frac{0.5}{K} + \frac{4/3}{10000} \right) = 0.01$$

$$\therefore K = 714.28 \text{ t/m}$$

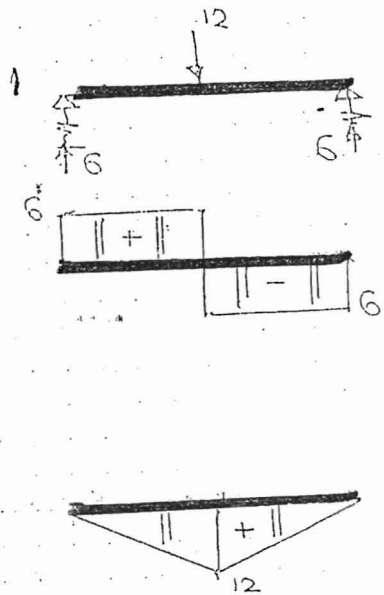
Final B.M.D, S.F.D



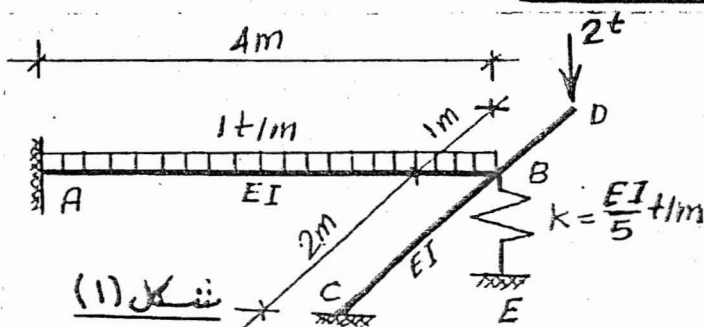
Reactions

S.F.D

B.M.D



EX(6) Jan (2001)



أجب عن خمسة أسئلة فقط من الأسئلة الآتية

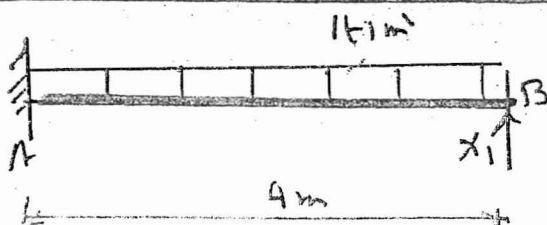
١- الكمرتان "AB" و "CBD" المبينتان بشكل (١) لهما نفس

القطاع وترتكزان ارتكازاً بسيطاً على ركيزة مرنة عند "B"

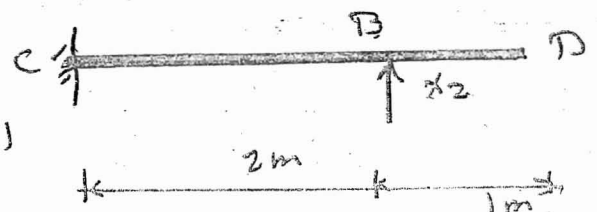
ارسم شكل عزم الانحناء للكمرتين نتيجة الأحمال المؤثرة

وإذا علم أن  $EI = 5000 \text{ t.m}^2$  إحص مقدار الترخيم

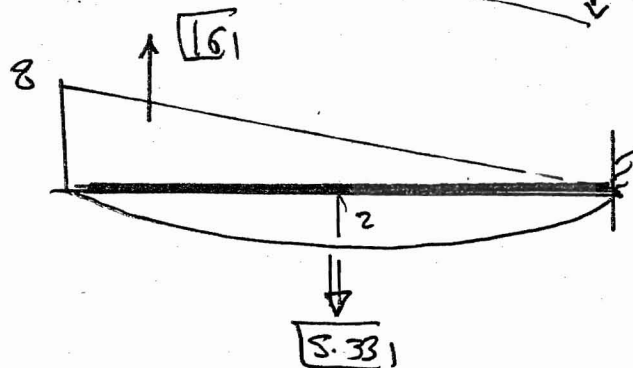
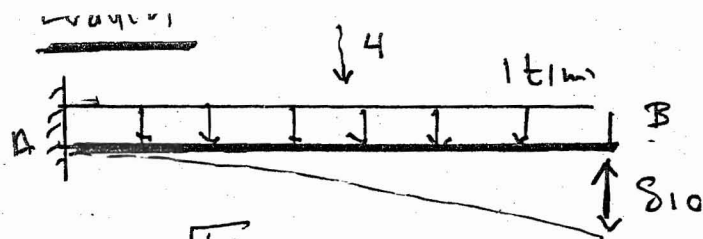
عند "B"



Beam (AB)

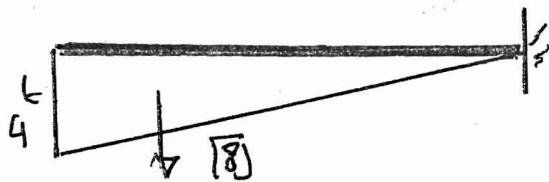
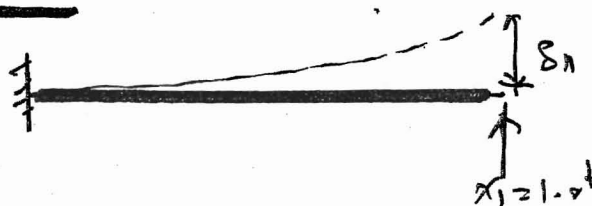


Beam (CBD)



$$\therefore \delta_{10} = \frac{32}{EI}$$

Load (1)



$$\therefore \delta_{11} = \frac{-21.33}{EI}$$

Condition

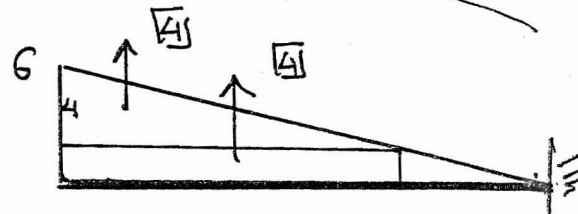
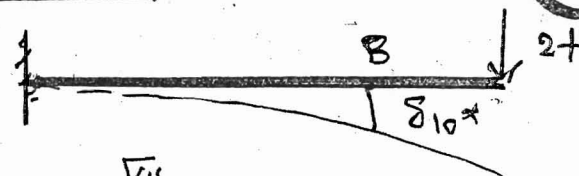
$$\delta_{10} + x_1 \delta_{11} = \frac{x_1 + x_2}{K}$$

$$\frac{32}{EI} - \frac{21.33}{EI} x_1 = \frac{x_1 + x_2}{EI/5}$$

$$21.33 x_1 - 2.67 x_2 = 22.67 \rightarrow (1)$$

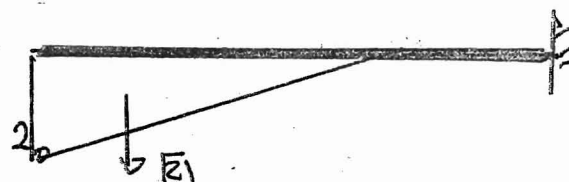
$$x_1 = 1.123t \text{ s } x_2 = 0.4185t$$

Load (a)



$$\delta_{10}^* = \frac{9.33}{EI}$$

Load (1)



$$\delta_{11}^* = \frac{-2.67}{EI}$$

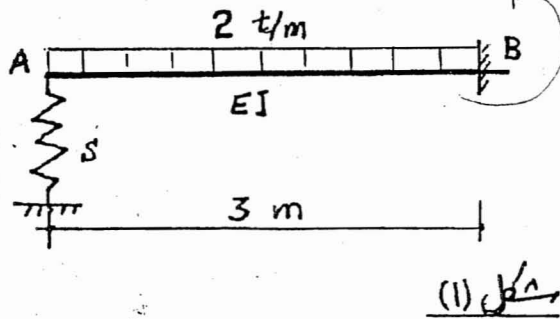
Condition

$$\delta_{10}^* + x_1 \delta_{11}^* = \frac{x_1 + x_2}{K}$$

$$\frac{9.33}{EI} - \frac{2.67}{EI} x_1 = \frac{x_1 + x_2}{EI/5}$$

$$26.33 x_1 + 5 x_2 = 32 \rightarrow (2)$$





- للكمرة المثبتة عند B والمرتكزة ارتكازاً مرناً عند A والمبينة بشكل (1) أوجد باستخدام طريقة التجميع أشكال القص وعزم الانحناء (B.M.D., S.F.D.) نتيجة للحمل المبين بالإضافة إلى دوران ضد اتجاه عقارب الساعة عند B قدره 0.001 رادي إذا علمت أن:  $S=1000 \text{ t/m}$ ,  $EI=10000 \text{ t.m}^2$

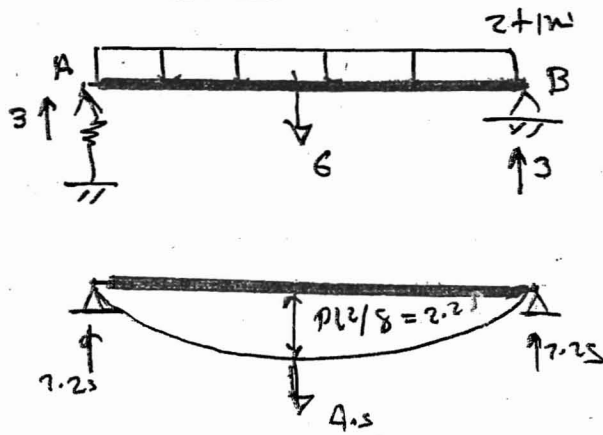
(1) Degree  $D = 3 - 2 = 1$

(2) M.S'

\* حدث دوران عند B لذلك

مسطرة الزاوية (MB) M.S

(3) Load (0)



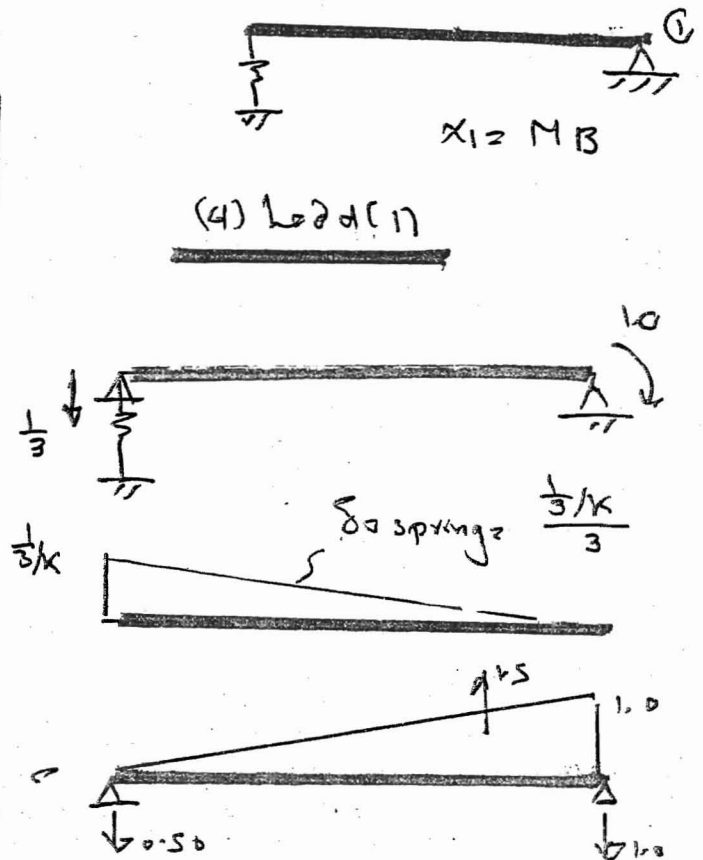
هبوط الزنبرك  $\frac{R}{K} \rightarrow \frac{3}{K}$

$$\delta_{10} = \frac{-2.25}{EI} - \frac{\frac{3}{K}}{L}$$

دوران

$$\delta_{10} = \frac{-12.25}{EI}$$

(4) Load (1)



$$\delta_{11} = \frac{\frac{1}{3K}}{3} + \frac{1.0}{EI} = \frac{2.11}{EI}$$

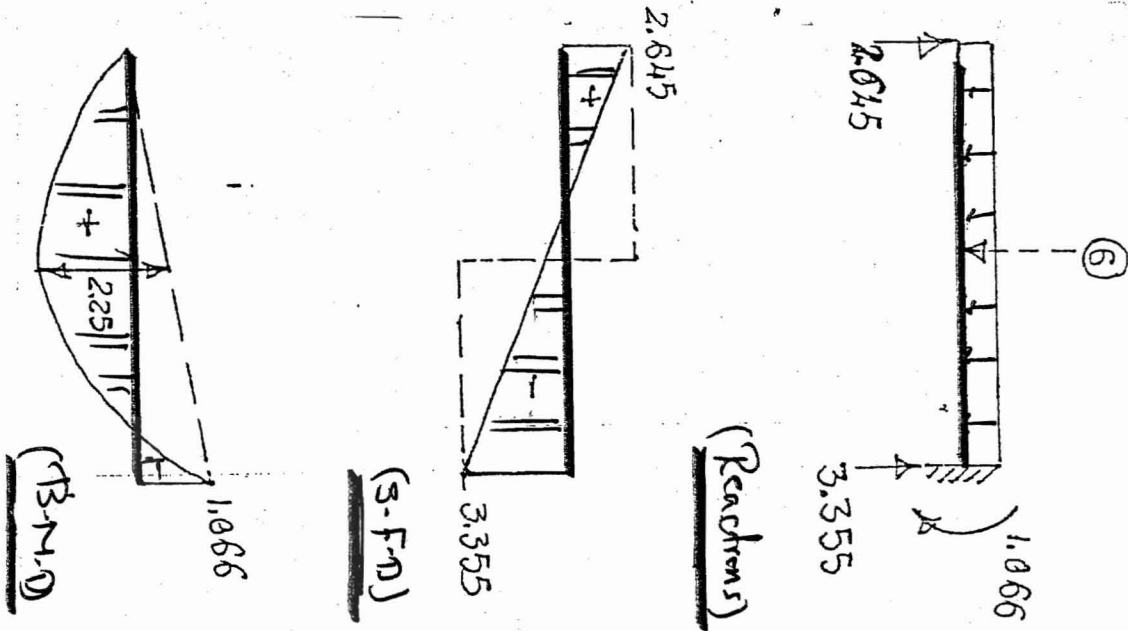
(5) Condition

$\delta_{10} + X_1 \delta_{11} = \theta_B = -0.001 \text{ rad}$  دوران الساعة

$$-\frac{12.25}{EI} + \frac{2.11}{EI} X_1 = -0.001$$

$$X_1 = 1.66 \text{ km} = MB$$

(6) الزخم عند A.  $Y_A = \frac{R_A}{S} = \frac{2.645}{1000} = 0.002645 \text{ m}$

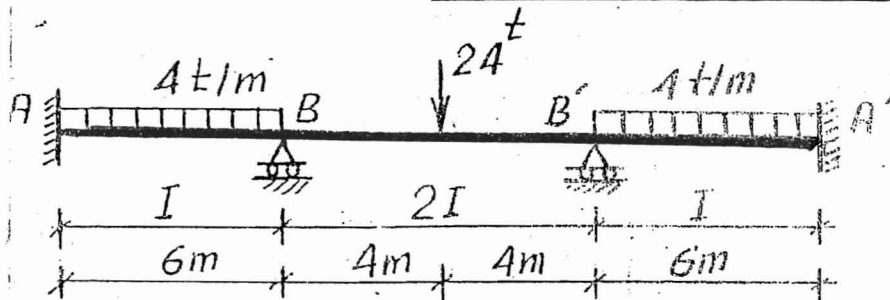


### EX (8) NOV (2003)

للكمرة المتماثلة المبينة بشكل (٢)

المطلوب:-

(١) ارسم شكل عزم الإحناء وشكل القص للكمرة نتيجة الأحمال المبينة وذلك باستخدام طريقة التجميع.



شكل (٢)

(1) Degree

$$6-2 = 4$$

$$\frac{4}{2} = 2$$

(2) M.O.S

$$x_1 = y_B$$

$$= y_{B'}$$

$$x_2 = M_A = M_{A'}$$

إذا علم أن  $EI = 20000 \text{ t.m}^2$  ارسم

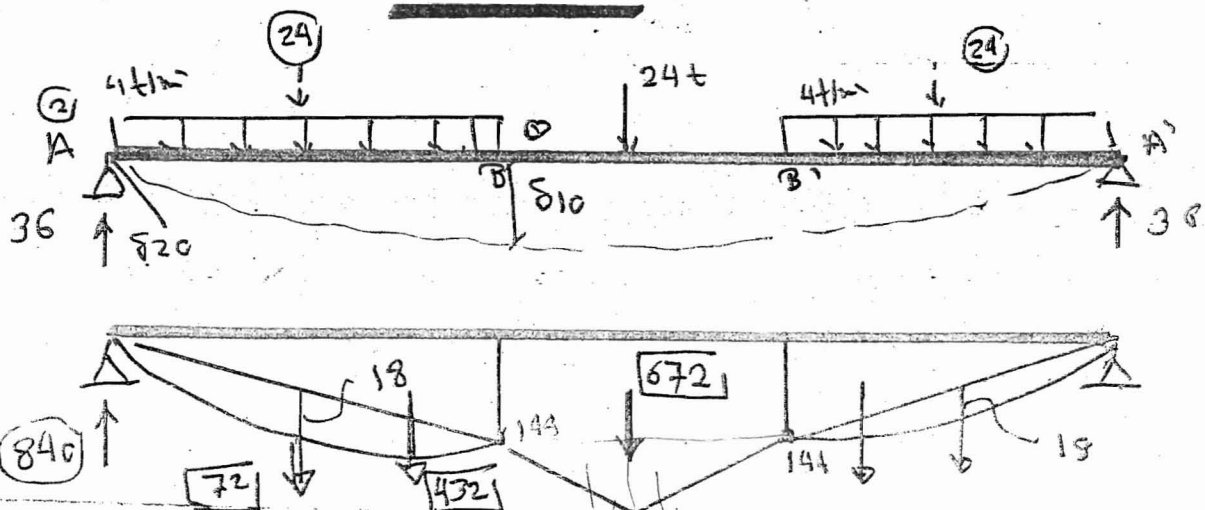
شكل عزم الإحناء للكمرة نتيجة

هبوط وتساوى قدره ٥ سم عند

الركيزتين B, B'

ذلك باستخدام طريقة التجميع.

(3) Load (٥)

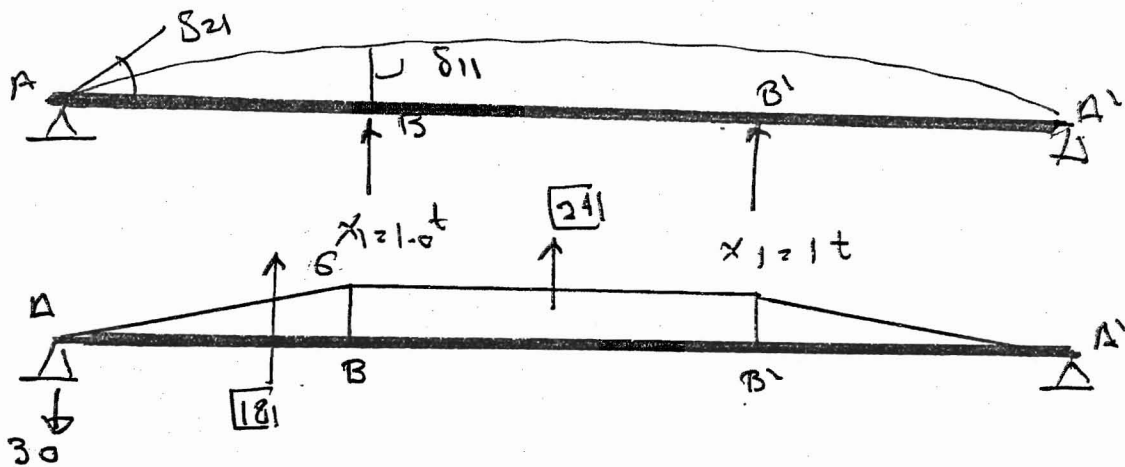


$$\star \delta_{10} = \frac{MB}{EI} = \frac{3960}{EI}$$

$$\star \delta_{20} = \frac{QA}{EI} = \frac{840}{EI}$$

(13)

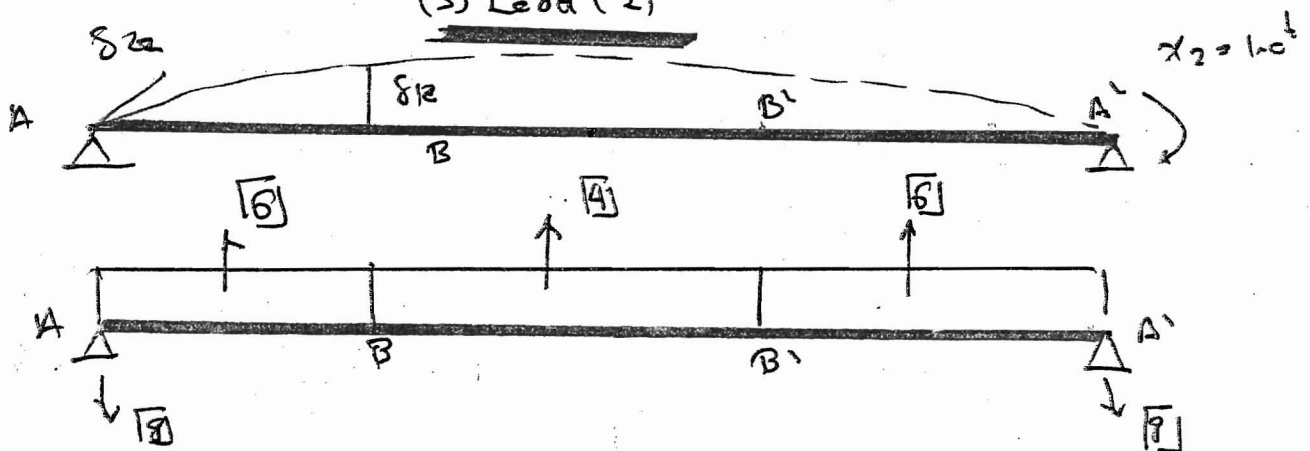
(4) Load (1)



$$\star \delta_{12} = \frac{MB}{EI} = \frac{-144}{EI}$$

$$\star \delta_{21} = \frac{QA}{EI} = \frac{-30}{EI}$$

(5) Load (2)



$$\star \delta_{12} = \frac{-30}{EI}$$

$$\star \delta_{22} = \frac{-8}{EI}$$

at (B)

(6) Condition

at (A)

$$\delta_{10} + \delta_{11} x_1 + \delta_{12} x_2 = 0.0$$

$$\frac{3960}{EI} - \frac{144}{EI} x_1 = \frac{30}{EI} x_2$$

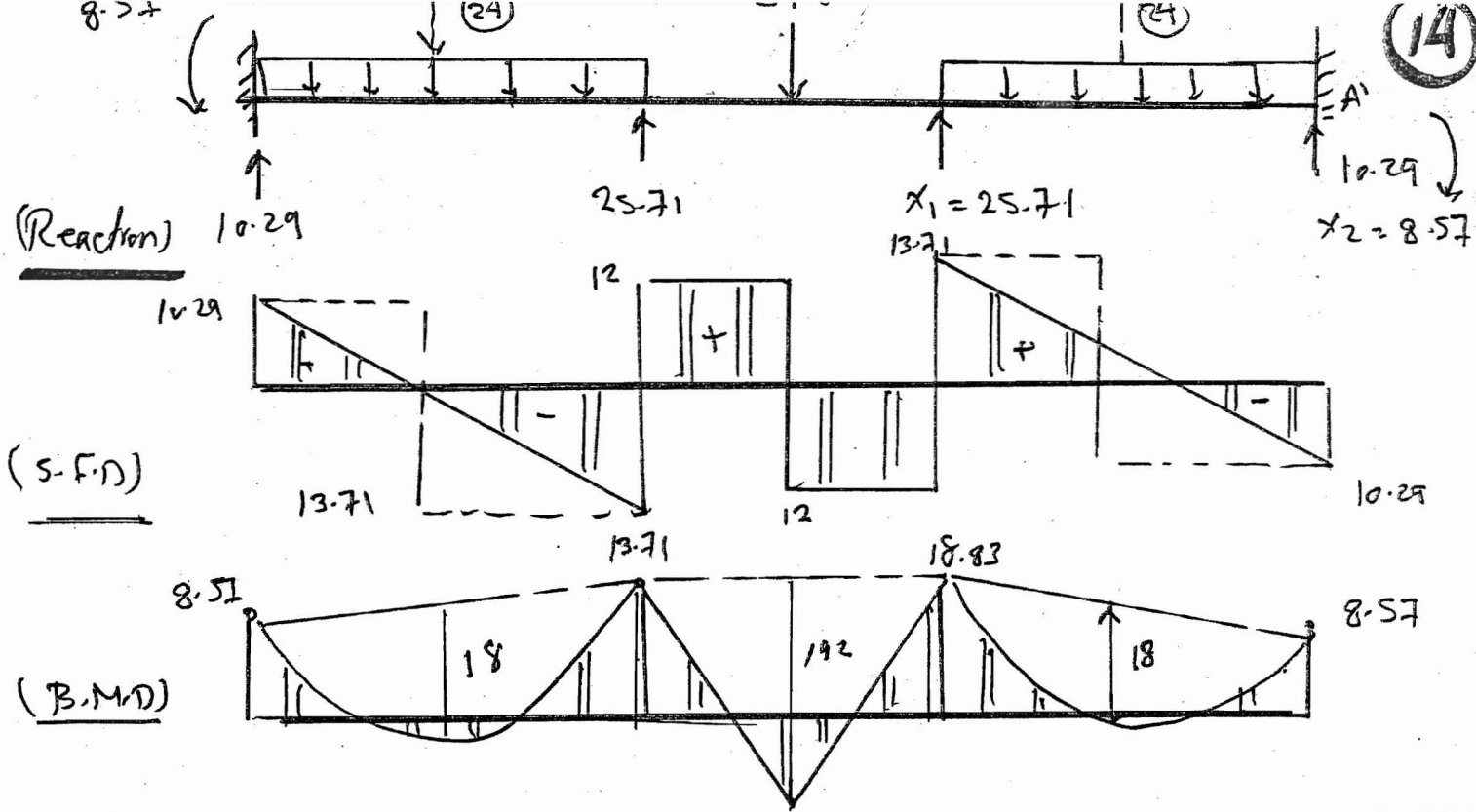
$$144 x_1 + 30 x_2 = 3960 \rightarrow (1)$$

$$\delta_{20} + \delta_{21} x_1 + \delta_{22} x_2 = 0.0$$

$$\frac{840}{EI} - \frac{30}{EI} x_1 - \frac{8}{EI} x_2 = 0.0$$

$$30 x_1 + 8 x_2 = 840 \rightarrow (2)$$

$$\star \text{ (جواباً على السؤالين (1) و (2) ) } MA = MA' = x_2 = 8.57 \text{ tm}$$



(\*) مطلوب إيجاد العزم نتيجة الهبوط فقط (هامه)

معناه لا تأخذ في الاعتبار الاضال الأساسية

$$\delta_{10} = 0.0$$

$$\delta_{20} = 0.0$$

نحتاج (  $\delta_{11}$  ,  $\delta_{21}$  ) و  $x_1 = 1.0$  م

$$\delta_{11} = \frac{-144}{EI}$$

$$\delta_{21} = \frac{-30}{EI}$$

نحتاج (  $\delta_{12}$  ,  $\delta_{22}$  ) و  $x_2 = 1.0$  م

$$\delta_{12} = \frac{-30}{EI}$$

$$\delta_{22} = \frac{-8}{EI}$$

at (B)  $\rightarrow 0.0 + \delta_{11} x_1 + \delta_{12} x_2 = \frac{0.5}{100}$  ↓

$$\frac{-144}{EI} x_1 + \frac{-30}{EI} x_2 = 0.005 \rightarrow (1)$$

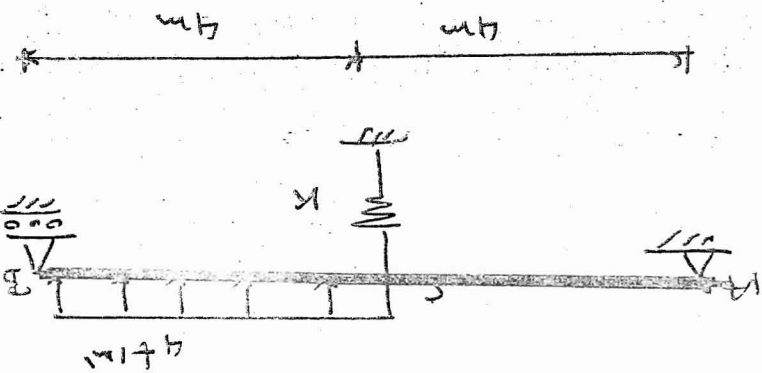
at (A)  $\rightarrow 0.0 + \delta_{21} x_1 + \delta_{22} x_2 = 0.0$

نحتاج  
B  
نحتاج

نحتاج  
نحتاج  
نحتاج



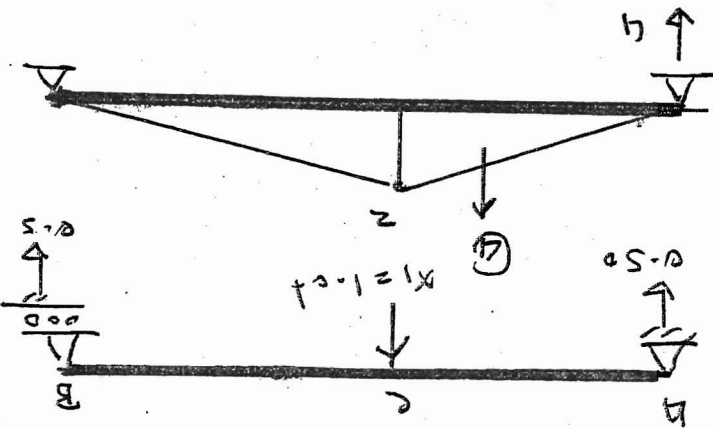
(1) Degree of freedom (DOF) = 3 - 2 = 1  
 Reactions: S.F., B.M.D.  
 (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) (154) (155) (156) (157) (158) (159) (160) (161) (162) (163) (164) (165) (166) (167) (168) (169) (170) (171) (172) (173) (174) (175) (176) (177) (178) (179) (180) (181) (182) (183) (184) (185) 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(1) Degree of freedom (DOF) = 3 - 2 = 1

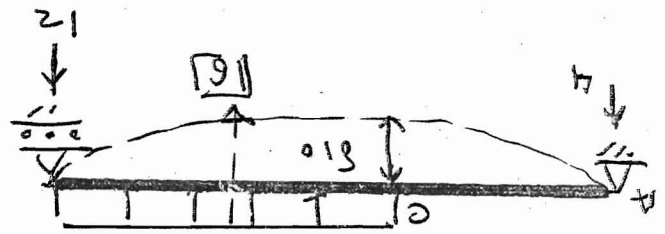
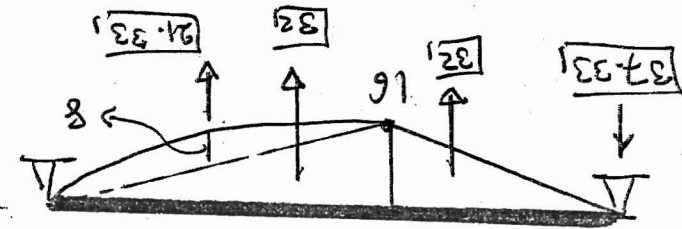


(4) Load (1)



$$* \delta_{11} = \frac{M_C}{EI} = \frac{-10 \frac{3}{2}}{EI}$$

(5) Condition



(3) Load (1)

$$* \delta_{10} = \frac{M_C}{EI} = \frac{10.67}{EI}$$

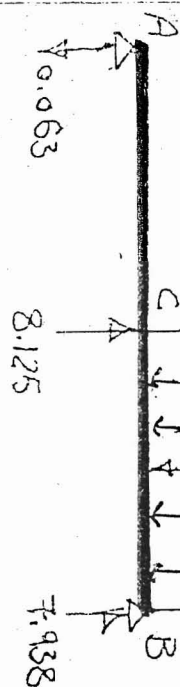
$$\Delta f (c) \delta_{10} + X_1 \delta_{11} = y_c \rightarrow 0.2 \text{ cm} = \frac{100}{0.2} \text{ m}$$

$$106.67 \frac{EI}{10.67} - \frac{EI}{10.67} X_1 = 0.002 \times EI$$

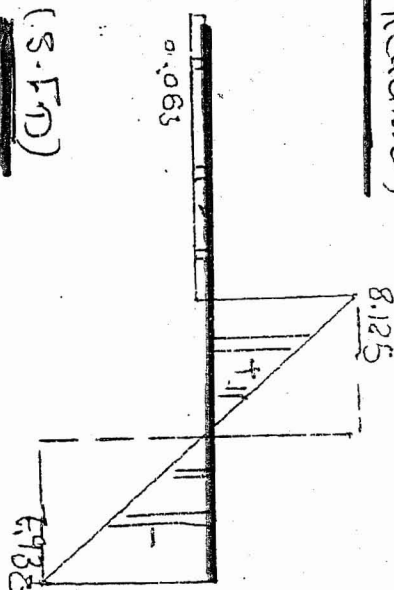
$$106.67 - 10.67 X_1 = 0.002 \times 10000$$

$$106.67 - 10.67 X_1 = (106.67 - 20) / 10.67$$

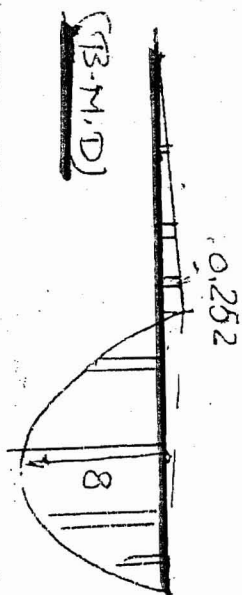
$$X_1 = Y_c = 8.125$$



(Reactions)



(S.F.D)



(B.M.D)