



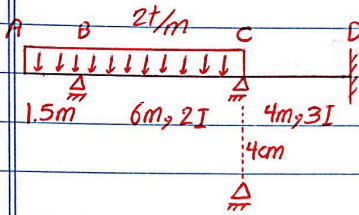
جزوه باما

دانشجویان و اساتید توجه داشته باشید جزوه موجود به صورت اختصاصی توسط وب سایت **جزوه باما** تهیه شده است و تمامی حقوق مادی و معنوی آن برای این وب سایت محفوظ می باشد.

Jozvebama.ir

روش سبب افت

با استفاده از روش سبب افت سازه نشان داده شده را تحلیل کرده و دیگراگر M الگراف منشی و منحنی الاستیک



$$E = 2 \times 10^3 \text{ t/cm}^2$$

آن را رسم کنید.

$$I = 3 \times 10^3 \text{ cm}^4$$

$$\Delta = 4 \text{ cm}$$

$$M_{AB} = \frac{2EI}{L} [2\theta_A + \theta_B - \frac{3\Delta}{L}] \pm FEM$$

$$\left(\frac{2EI}{L}\right)_{BC} = \left(\frac{2 \times 2 \times 10^3 \times 2 \times 3 \times 10^3}{600}\right) = 40000$$

$$\left(\frac{2EI}{L}\right)_{CD} = \left(\frac{2 \times 2 \times 10^3 \times 3 \times 3 \times 10^3}{400}\right) = 90000$$

$$\psi_{BC} = \psi_{CB} = \frac{4}{600} = \frac{1}{150}$$

$$\psi_{CD} = \psi_{DC} = \frac{-4}{400} = \frac{-1}{100}$$

$$M_{BA} = 2 \times 1.5 \times 0.75 = 225 \text{ tm} = 225 \text{ tm}$$

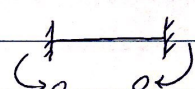
$$M_{BC} = 40000 \times \left[2\theta_B + \theta_C - 3\left(\frac{1}{150}\right)\right] - 600 =$$

$$\frac{\omega l^2}{12} = \frac{2 \times 6^2}{12} = 6 \text{ tm}$$

$$M_{CB} = 40000 \times \left[2\theta_C + \theta_B - 3\left(\frac{1}{150}\right)\right] + 600$$

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$$M_{CD} = 90000 \left[2\theta_C + \cancel{\theta_B} - 3 \left(\frac{-1}{100} \right) \right] - 0$$


$$M_{CD} = 180000\theta_C + 2700 \quad \text{FEM} = 0$$

$$M_{DC} = 90000 \left[2\theta_D + \theta_C - 3 \left(\frac{-1}{100} \right) \right] + 0$$

$$M_{DC} = 90000\theta_C + 2700$$

$$\text{I } \sum M_B = 0 \Rightarrow M_{BA} + M_{BC} = 0$$

$$\text{II } \sum M_C = 0 \Rightarrow M_{CB} + M_{CD} = 0$$

$$\text{I} \Rightarrow 225 + 80000\theta_B + 40000\theta_C - 1400 = 0$$

$$\text{II} \Rightarrow 80000\theta_C + 40000\theta_B - 200 + 180000\theta_C + 2700 = 0$$

$$\begin{cases} 80000\theta_B + 40000\theta_C = 1175 \\ 40000\theta_B + 260000\theta_C = -2500 \end{cases} \quad \begin{cases} 80000\theta_B + 40000\theta_C = 1175 \\ -80000\theta_B - 520000\theta_C = +5000 \end{cases}$$

$$-480000\theta_C = 6175 \Rightarrow$$

$$\theta_C = -0.0128645833$$

$$\theta_B = 0.02111979165$$

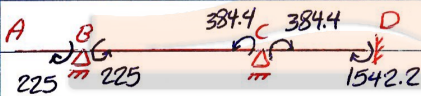
$$M_{BA} = 225 \text{ tcm}$$

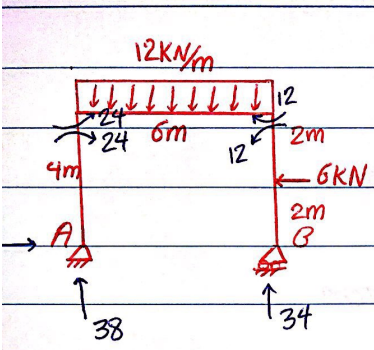
$$M_{GC} = 80000\theta_B + 40000\theta_C - 1400 = -225 \text{ tcm}$$

$$M_{CB} = 80000\theta_C + 40000\theta_B - 200 = -384.4 \text{ tcm}$$

$$M_{CD} = 180000\theta_C + 2700 = 384.4 \text{ tcm}$$

$$M_{DC} = 90000\theta_C + 2700 = 1542.2 \text{ tcm}$$

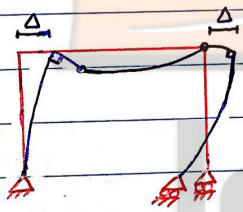
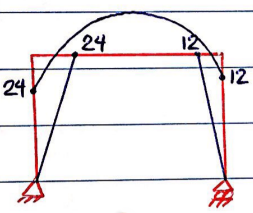




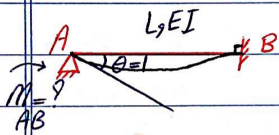
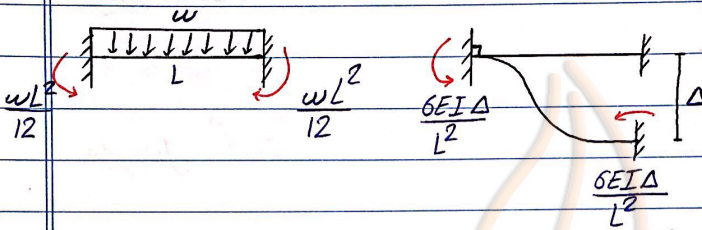
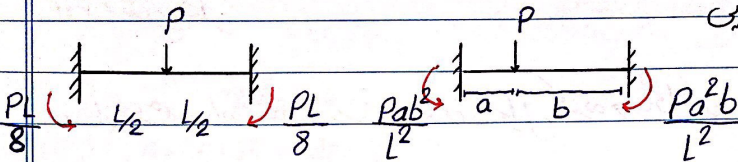
$$\overset{+}{\curvearrowright} \sum M_A = 0 \Rightarrow 12 \times 6 \times 3 - 6 \times 2 - B_y \times 6 = 0$$

$$B_y = 34$$

$$+\uparrow \sum F_y = 0 \Rightarrow A_y + 34 - 12 \times 6 = 0 \Rightarrow A_y = 38$$



لنگرهای گیردار انتهای

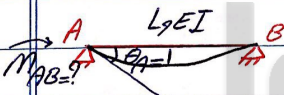


$$M_{AB} = \frac{2EI}{L} [2\theta_A + \theta_B - 3\frac{\Delta}{L}] + FEM$$

$$M_{AB} = \frac{4EI}{L}$$

سختی دورانى مطلق

سختی دورانى کاهش یافته



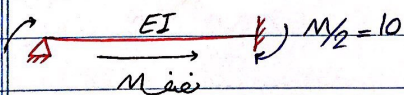
$$M_{AB} = \frac{2EI}{L} [2\theta_A + \theta_B - 3\frac{\Delta}{L}] + FEM$$

$$M_{AB} = \frac{2EI}{L} [2 + \theta_B]$$

$$\Rightarrow M_{AB} = \frac{3EI}{L}$$

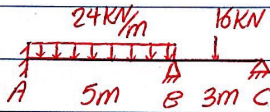
$$M_{BA} = \frac{2EI}{L} [2\theta_B + 1]$$

20kNm

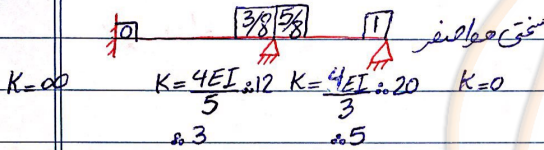


روش توزیع انرژ

از منتهای داده شده با از راه مختلف تحلیل کرده و دیگر کمات تقریبی کثرت فرشی و منتهای الاستیک آن را رسم کنید.

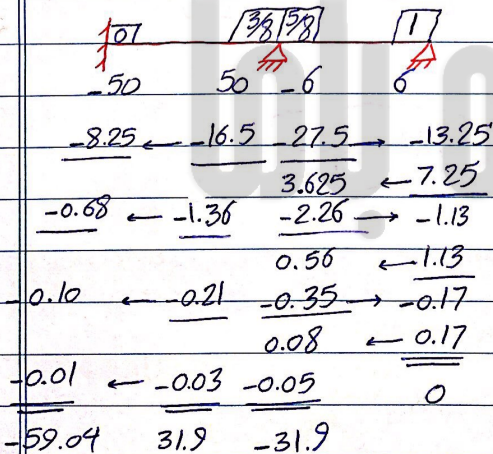


فرض اول گره C گیردار

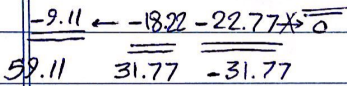
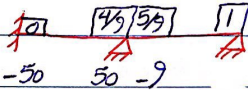
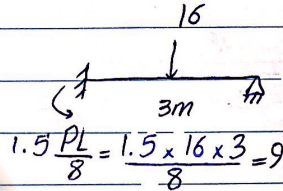
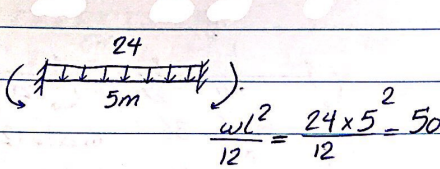
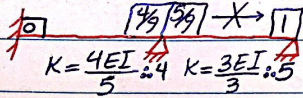


$$\frac{wL^2}{12} = \frac{24 \times 5^2}{12} = 50$$

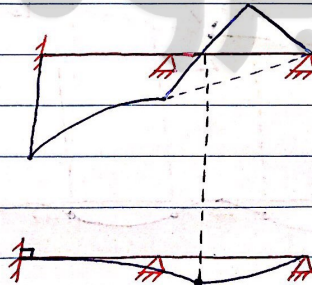
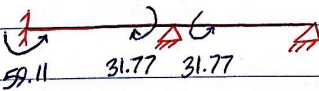
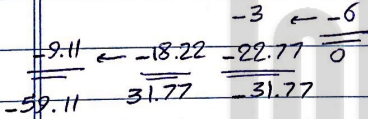
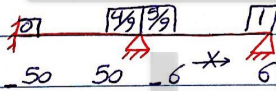
$$\frac{PL}{8} = \frac{16 \times 3}{8} = 6$$



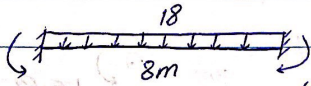
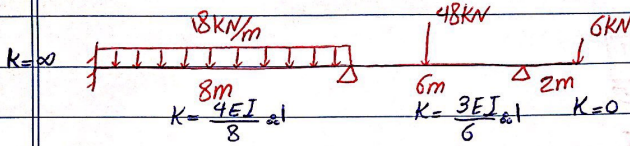
فرض دوم گروه مفصل بار



فرض سوم اول گروه گیردار سپس آزاد می کنیم



تیر مقابل را بر روش توزیع انگر تحلیل کنید.

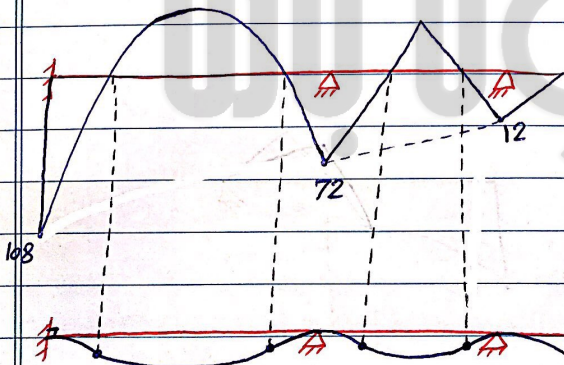
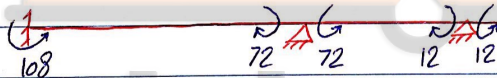


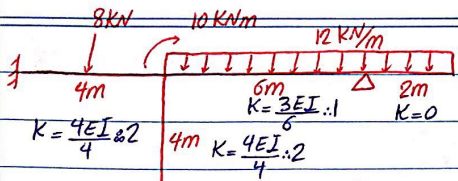
$$\frac{wL^2}{12} = \frac{18 \times 6^2}{12} = 96$$

$$\frac{PL}{8} = \frac{48 \times 6}{8} = 36$$

$$6 \times 2 \times 1 = 12$$

101	0.5 0.5	1 0
-96	96 -36	36 -12
	-12 ←	-24 0
-12	← -24 -24	12 -12
-108	72 -72	





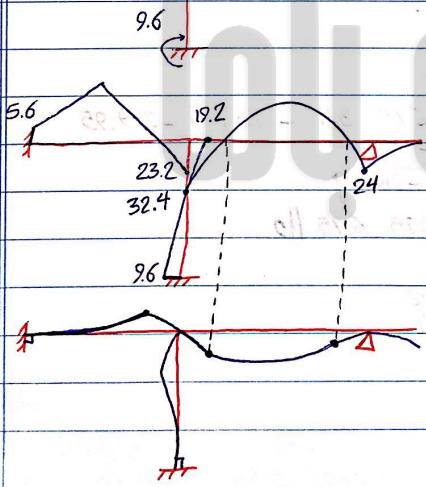
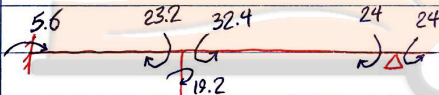
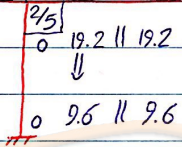
تحليل قاب مقابل باروش و بخش گند

$$wL^2 = \frac{12 \times 6^2}{12} = 36$$

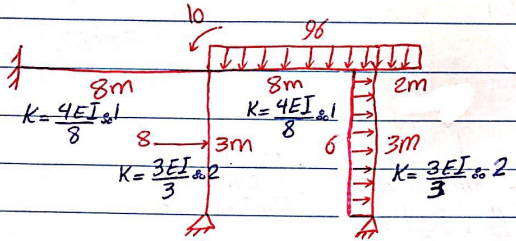
$$\frac{PL}{8} = \frac{8 \times 4}{8} = 4$$

$$12 \times 2 \times 1 = 24$$

<u>5.6</u>	<u>23.2</u>	<u>-32.4</u>		<u>24</u>	<u>-24</u>
9.6	← 19.2	9.6		← -12	0
-4	4	-36		36	-24
<u>10</u>	<u>8.5</u>	<u>13.5</u>		<u>1</u>	<u>0</u>

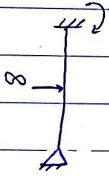


مطلوب است تحلیل قاب زیر به روش مینیمم پتانسیل:



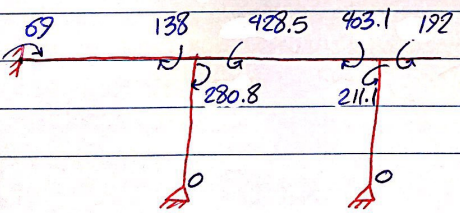
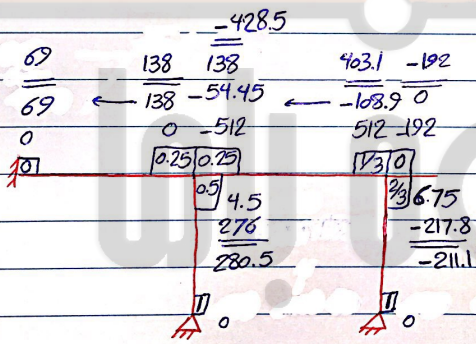
$$\frac{wL^2}{12} = \frac{96 \times 8^2}{12} = 512$$

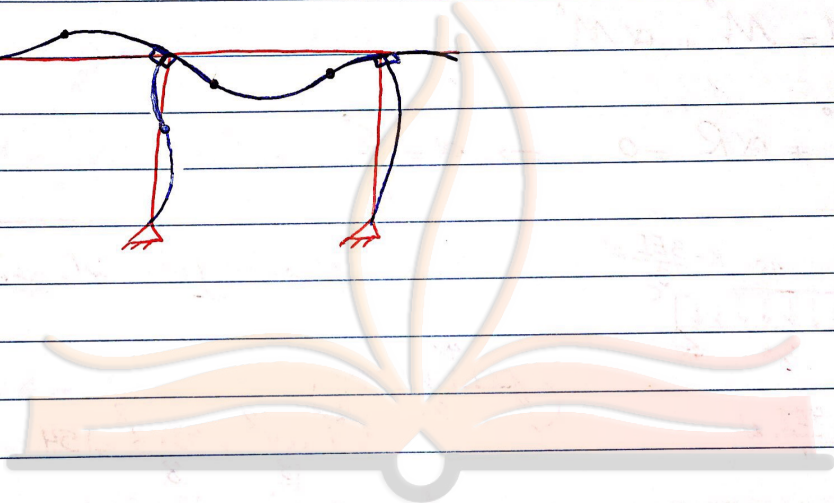
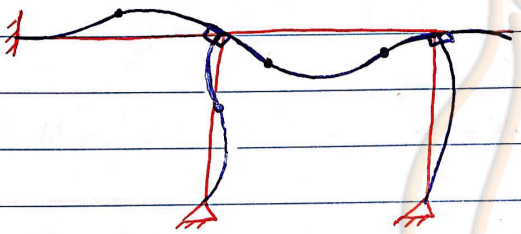
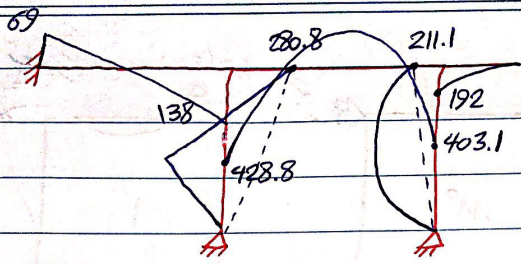
$$96 \times 2 \times 1 = 192$$



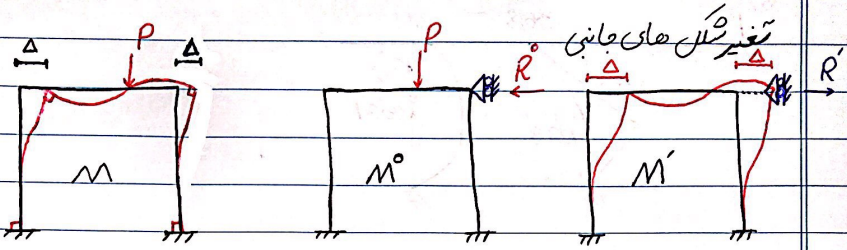
$$-1.5 \frac{wL^2}{12} = -1.5 \times \frac{6 \times 3^2}{12} = -6.75$$

$$1.5 \frac{PL}{8} = 1.5 \times \frac{8 \times 3}{8} = 4.5$$



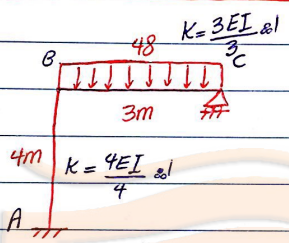


میزبان

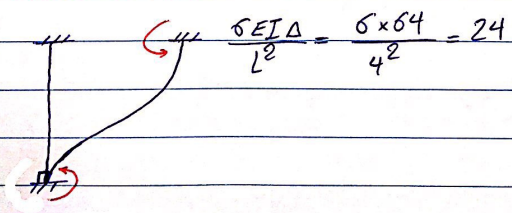
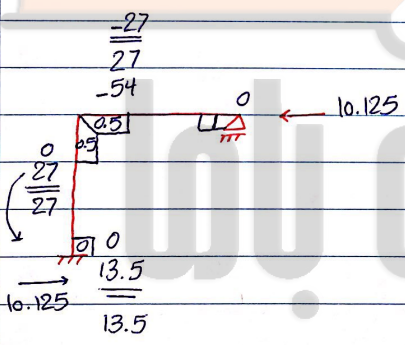
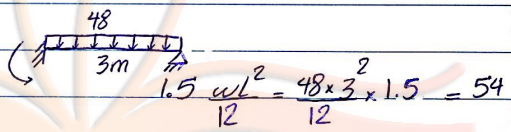


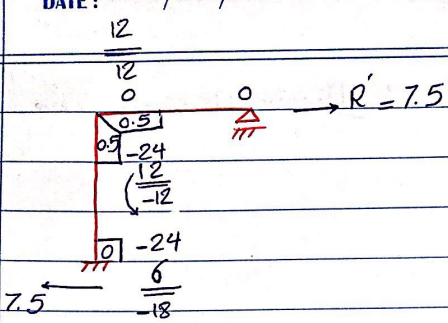
$$M = M^{\circ} + \alpha M'$$

$$-R^{\circ} + \alpha R' = 0 \Rightarrow \alpha = \frac{R^{\circ}}{R'}$$



مطلوب است تحلیل سازه معادل





$$\alpha = \frac{R'}{R} = \frac{10.125}{7.5} = 1.35$$

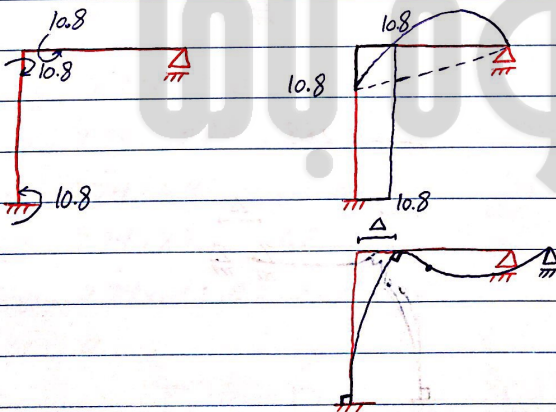
$$M = \alpha M' + M^0 \Rightarrow$$

$$M_{AB} = 1.35 \times -18 + 13.5 = -10.8$$

$$M_{BA} = 1.35 \times -12 + 27 = 10.8$$

$$M_{BC} = 1.35 \times 12 + -27 = -10.8$$

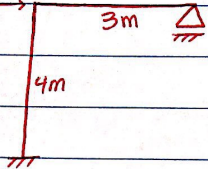
$$M_{CB} = 1.35 \times 0 + 0 = 0$$



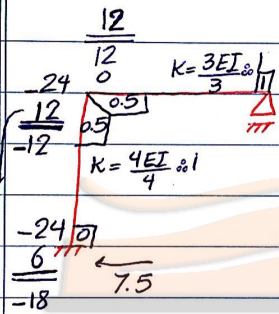
12 kN

$R^0 = 12$

مطلوب است تحلیل از همتابیل



$$\frac{6EI\Delta}{l^2} = \frac{6 \times 64}{16} = 24$$



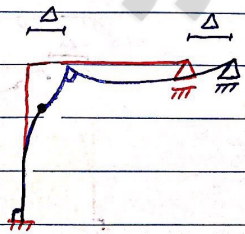
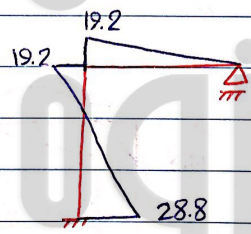
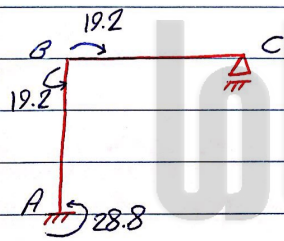
$$R' = 7.5$$

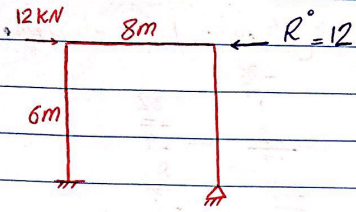
$$\alpha = \frac{R^0}{R'} = \frac{12}{7.5} = 1.6$$

$$M_{BA} = 1.6 \times -12 + 0 = -19.2$$

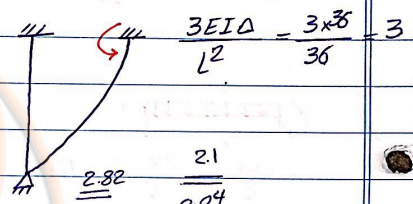
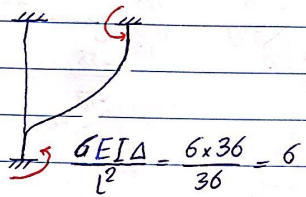
$$M_{AB} = 1.6 \times -18 + 0 = -28.8$$

$$M_{BC} = 1.6 \times 12 + 0 = 19.2$$

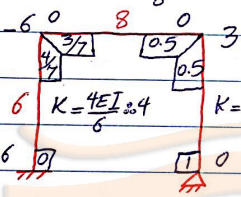




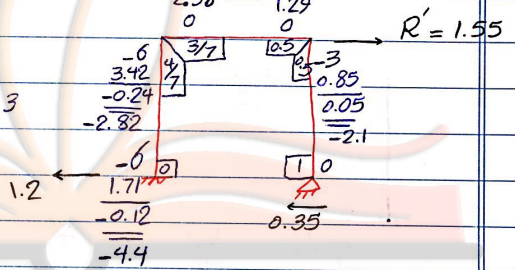
مطلوب است تحلیل سازه معادل!



$K = \frac{4EI}{8} = 3$



$K = \frac{3EI}{6} = 3$



$\alpha = \frac{R'}{R} = 7.74$

$M_{AB} = 7.74 \times -4.4 = -34.1$

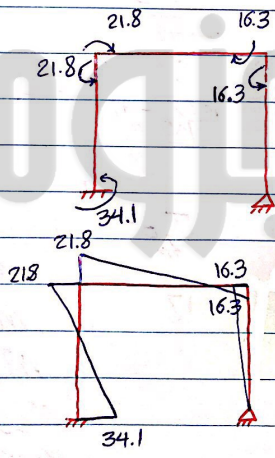
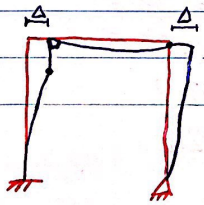
$M_{BA} = 7.74 \times -2.82 = -21.8$

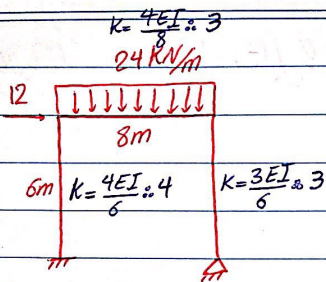
$M_{BC} = 7.74 \times 2.82 = 21.8$

$M_{CB} = 7.74 \times 2.1 = 16.3$

$M_{CD} = 7.74 \times -2.1 = -16.3$

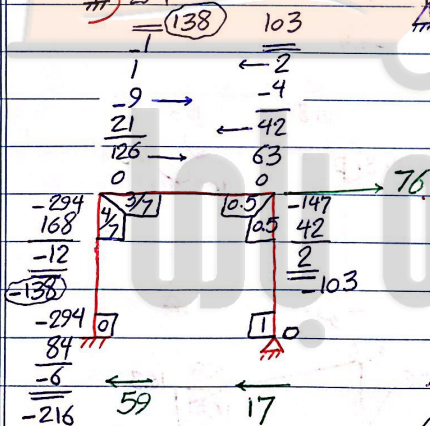
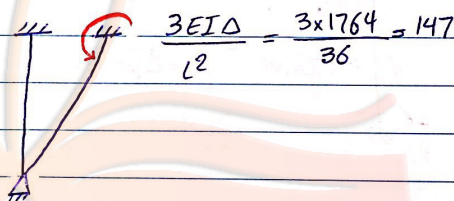
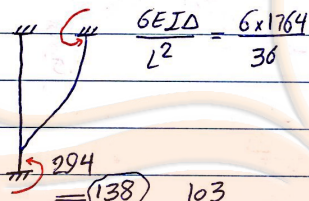
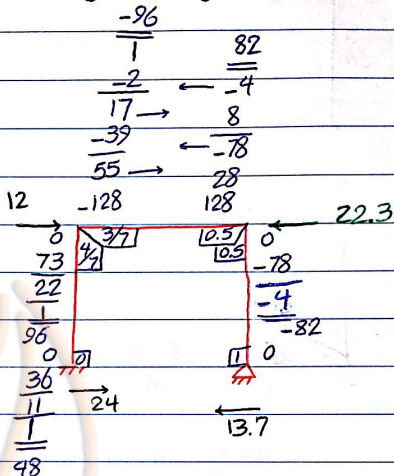
$M_{DC} = 0$





مطلوب است تحلیل سازه مقابل

24
 $\frac{wL^2}{12} = \frac{24 \times 64}{12} = 128$



$\alpha = \frac{R''}{R'} = \frac{22.3}{76}$

$\alpha = 0.2934210526$

$M_{AB} = -15.4$

$M_{BA} = 55.5$

$M_{BC} = -55.5$

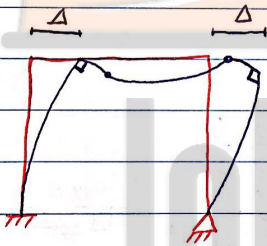
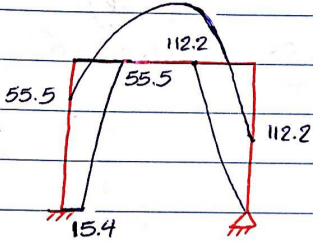
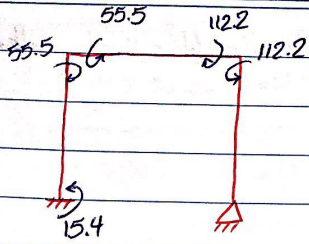
$M_{CB} = 112.2$

$M_{CD} = -112.2$

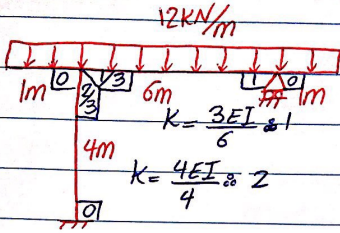
$M_{DC} = 0$

DATE: / /

SUB: _____

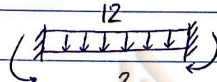


مطلوب: - ايجاد كل من التحويل والزاوية



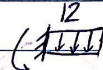
$$12 \times 1 \times 0.5 = 6$$

$$\begin{array}{r} 6 \\ 0 \end{array} \quad \begin{array}{r} -36 \\ 15 \end{array}$$



$$\frac{wL^2}{12} = \frac{12 \times 6^2}{12} = 36$$

$$\begin{array}{r} 6 \\ -30 \end{array} \quad \begin{array}{r} 6 \\ 0 \end{array}$$

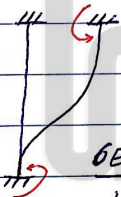


$$12 \times 1 \times 0.5 = 6$$

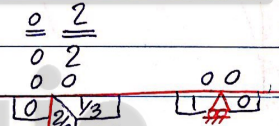
$$6 \quad -36 \quad \leftarrow R' = 11.25$$



$$\begin{array}{r} 11.25 \\ 15 \end{array}$$



$$\frac{6EI\Delta}{L^2} = \frac{6 \times 16}{16} = 6$$



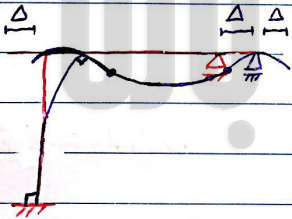
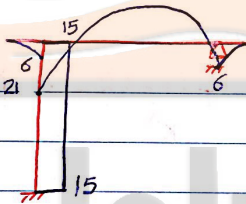
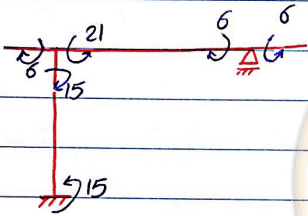
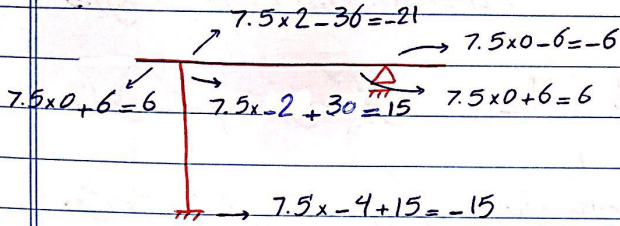
$$\begin{array}{r} 0 \\ 0 \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \\ 0 \end{array}$$

$$\begin{array}{r} 6 \\ 4 \\ -2 \end{array}$$

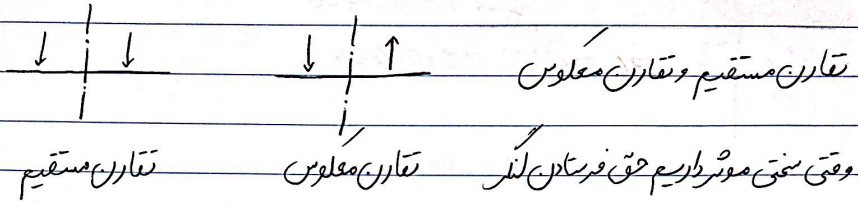
$$\begin{array}{r} -6 \\ 2 \\ -4 \end{array}$$

$$\leftarrow 1.5$$

$$\alpha = \frac{R''}{R'} = \frac{11.25}{1.5} = 7.5$$



تقارن سازه‌های متقارن دوگانه اند:



$$k^e = \frac{1}{2} k$$

$x \rightarrow$

$$k^e = \frac{3}{2} k$$

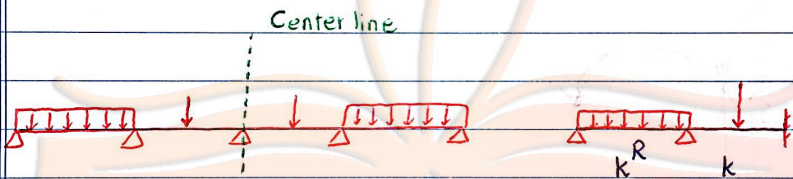
$x \rightarrow$

به سمت دیگر می‌انگاریم

تقارن مستقیم تیرها دهانه زوج

سازه اصلی

سازه جایگزین

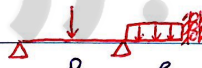


$$\theta_c = 0$$

M_c

C_L

تقارن مستقیم تیرها دهانه فرد



k^R

$$k^e = \frac{1}{2} k$$

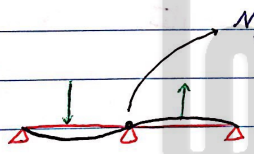
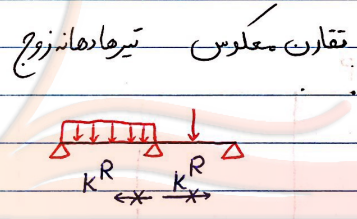
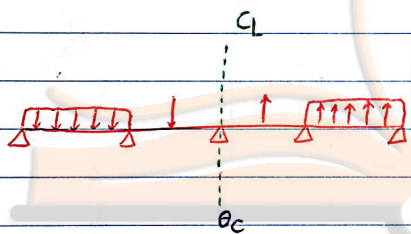
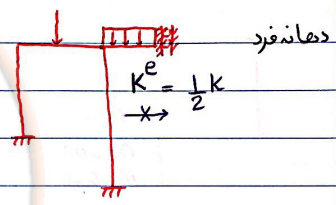
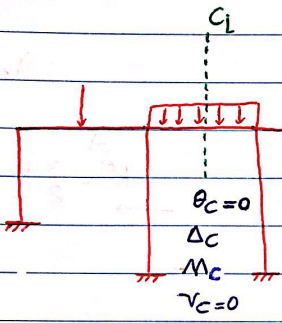
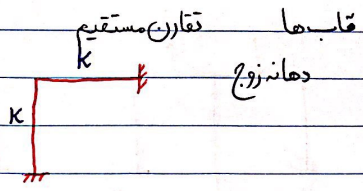
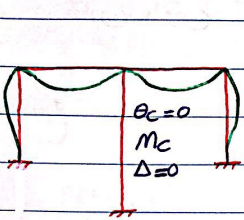
$x \rightarrow$

$$\theta_c = 0$$

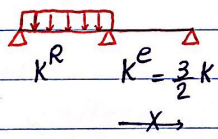
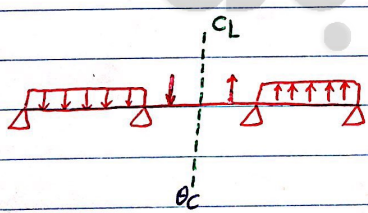
Δ_c

M_c

$$\gamma_c = 0$$

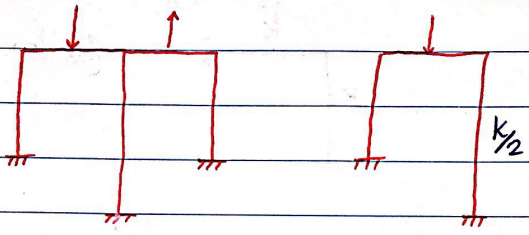


تقارن معکوس تیر دهانه فرد



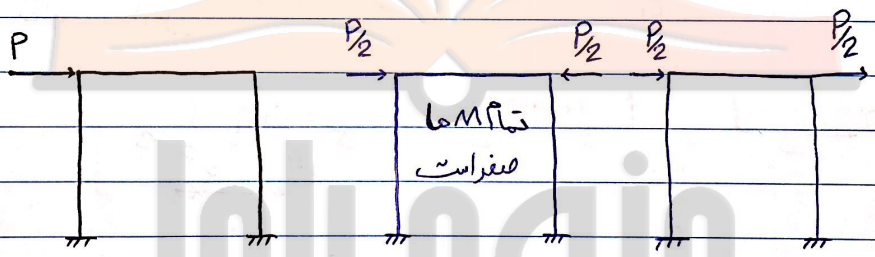
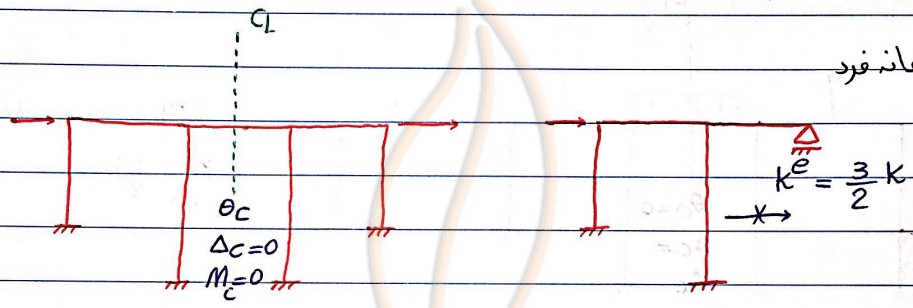
$M_c = 0$
 $\Delta_c = 0$

قالب تقارن معكوس



دهانه زوج

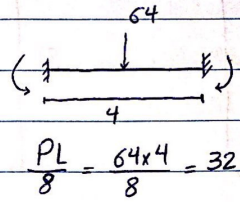
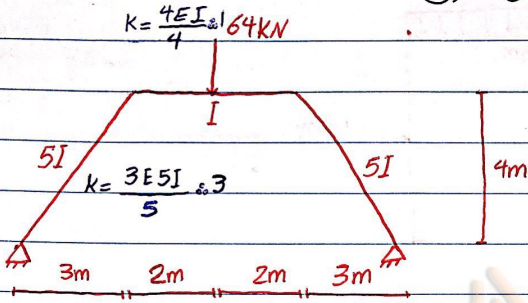
دهانه فرد



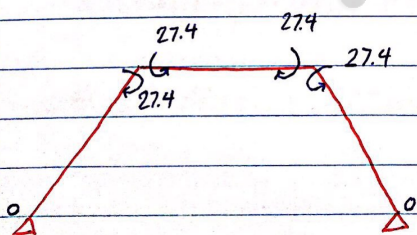
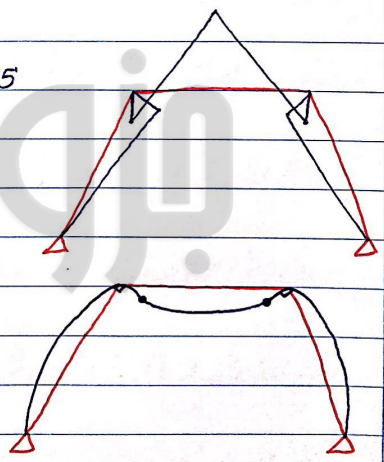
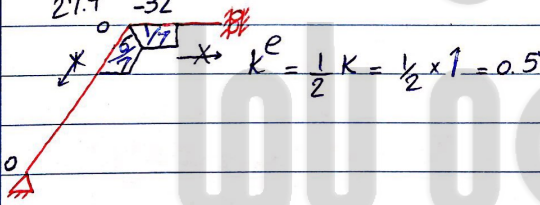
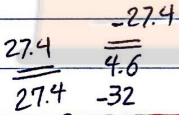
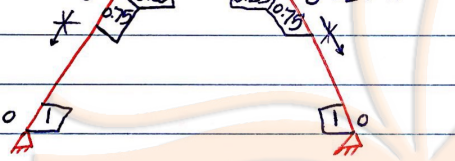
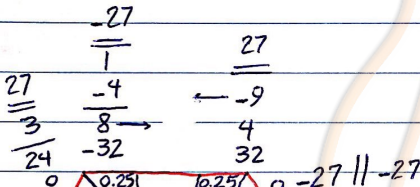
تقارن مستقیم

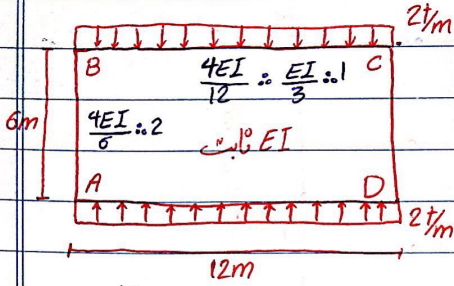
تقارن معكوس

مطلوب است تحلیل از مفاصل بیرونی تقارن!

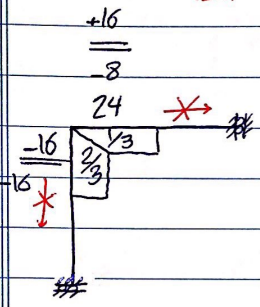


$$\frac{PL}{8} = \frac{64 \times 4}{8} = 32$$





- MBA
- -12t-m (1)
 - -16t-m (2)
 - -8t-m (3)
 - 12t-m (4)



روش تقریبی تحلیل سازه ها

(1) روش پرتال

(2) روش کاتیلیر

→ طرفی ای و بعضی کم بار تقاضا زیاد

(1) روش پرتال

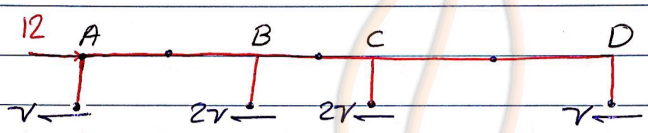
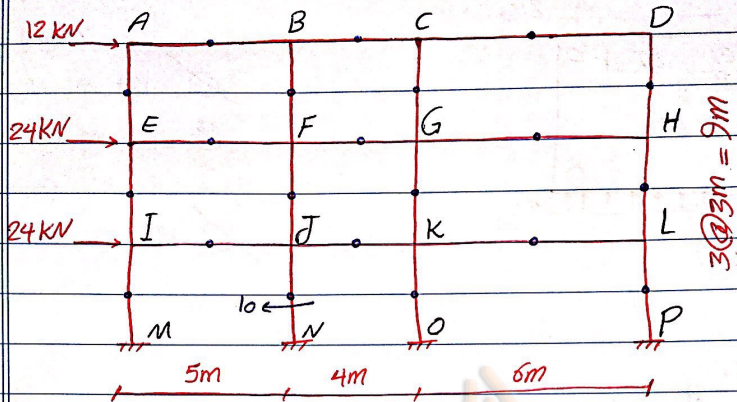
قدم اول اساس روش پرتال مثل بر سه فرض است :

(1) نقاط عطف تیر در وسط دهانه است. / (2) نقاط عطف ستون در وسط ارتفاع آن ها قرار دارد

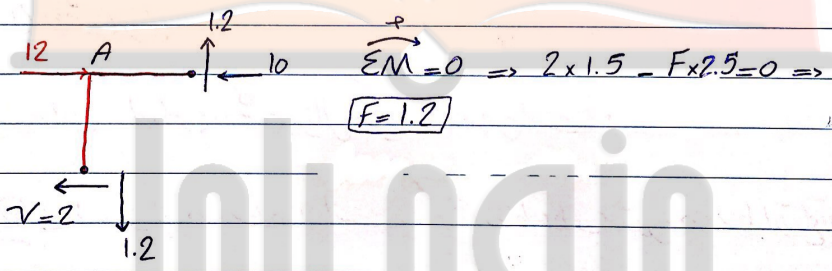
(3) نیروی برشی طبقه به نسبت یک سهم ستون های کناری و دو سهم ستون های میانی تقسیم می شود

سوال امتحانی : با استفاده از روش پرتال فقط لنگرهای MGB و MGN و

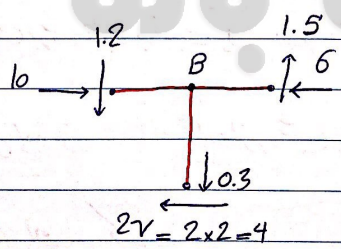
MKA را حساب کنید.



$$\sum F_x = 0 \Rightarrow 6V = 12 \Rightarrow \boxed{V = 2}$$



$$\sum M = 0 \Rightarrow 2 \times 1.5 - F \times 2.5 = 0 \Rightarrow \boxed{F = 1.2}$$



$$\sum M = 0 \Rightarrow 1.2 \times 4.5 + 4 \times 1.5 - F \times 2 = 0$$

$$F = 0.3$$

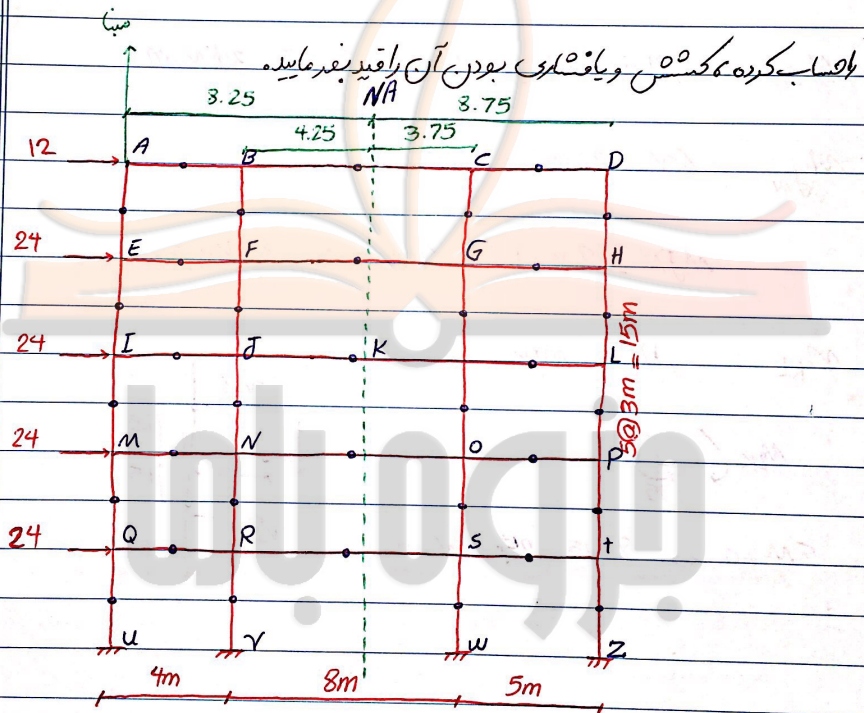
12 روش کانتیلیور

(1) نقاط عطف تیر در وسط دهانه است.

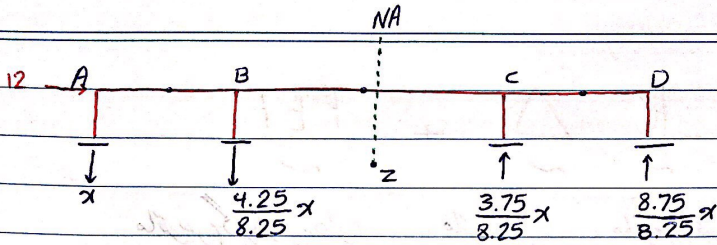
(2) نقاط عطف ستون در وسط ارتفاع آن ها قرار دارد.

(3) نیروی محوری ستون ها به نسبت فاصله های شان از تار فضی سافتمان حساب می شود.

سوال امتحانی: حداکثر و حداقل نیروی محوری در کدام ستون ها باشد نام برده و مقدارش



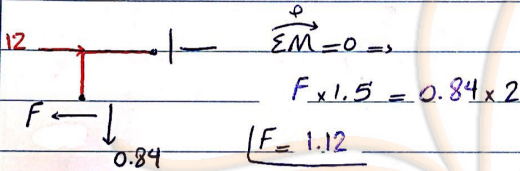
$$\bar{X} = \frac{\sum A\bar{x}}{\sum A} = \frac{A \times 0 + A \times 4 + A \times 12 + A \times 17}{4A} = 8.25$$



$$(\sum M_z = 0 \Rightarrow$$

$$\frac{8.25}{8.25} x \cdot 8.25 + \frac{4.25}{8.25} x (4.25) + \frac{3.75}{8.25} x (3.75) + \frac{8.75}{8.25} x (8.75) = 12 \times 1.5$$

$$\Rightarrow \frac{1}{8.25} (8.25^2 x + 4.25^2 x + 3.75^2 x + 8.75^2 x) = 12 \times 1.5 \Rightarrow x = 0.84$$



حاصل $N_{CG} = \frac{3.75}{8.25} \times 0.84 = 0.38$ فشاری

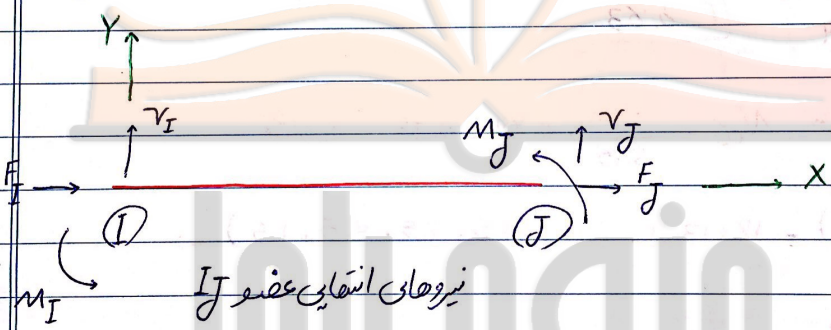
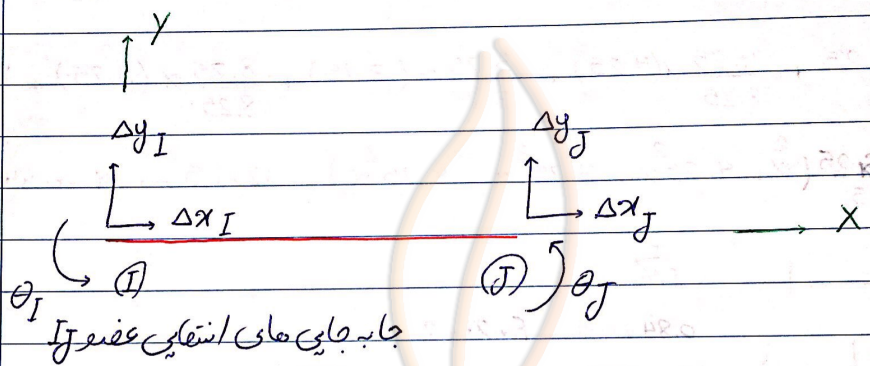
$$x (21.43) = 12 \times 13.5 + 24 \times (10.5 + 7.5 + 4.5 + 1.5) \Rightarrow$$

$$x = 34.44$$

حاصل $N_{1/2} = \frac{8.75}{8.25} \times 34.44 = 36.53$ فشاری

$$\underset{\sim}{F} = \underset{\sim}{K} \underset{\sim}{\Delta} + \underset{\sim}{FEF}$$

ماتریس نیروهای
 گیردار انتهای اعضا،
 ماتریس سختی
 جابجایی درگروهها،
 ماتریس سختی
 واریدگرهها



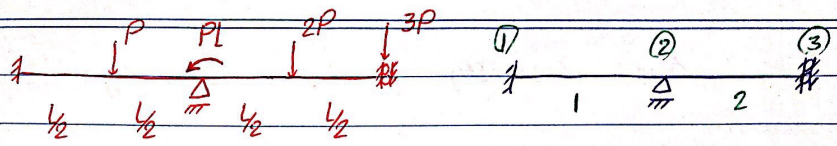
DATE : / /

SUB : _____

	Δ_{xI}	Δ_{yI}	θ_I	Δ_{xJ}	Δ_{yJ}	θ_J
F_I	$\frac{EA}{L}$	0	0	$-\frac{EA}{L}$	0	0
V_I	0	$\frac{12EA}{L^3}$	$\frac{6EA}{L^2}$	0	$-\frac{12EI}{L^3}$	$\frac{6EI}{L^2}$
M_I	0	$\frac{6EA}{L^2}$	$\frac{4EI}{L}$	0	$-\frac{6EI}{L^2}$	$\frac{2EI}{L}$
F_J	$-\frac{EA}{L}$	0	0	$\frac{EA}{L}$	0	0
V_J	0	$\frac{-12EI}{L^3}$	$\frac{-6EI}{L^2}$	0	$\frac{12EI}{L^3}$	$\frac{-6EI}{L^2}$
M_J	0	$\frac{6EI}{L^2}$	$\frac{2EI}{L}$	0	$-\frac{6EI}{L^2}$	$\frac{4EI}{L}$

DATE : / /

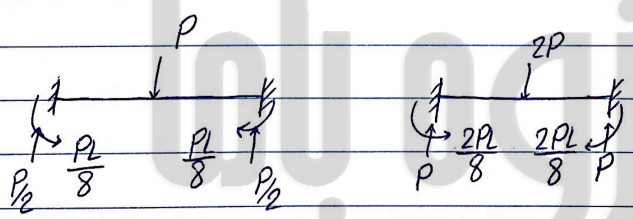
SUB : fix end forces



$$\tilde{F} = K \tilde{\Delta} + \tilde{F}_{EF}$$

$$\begin{Bmatrix} \tilde{F}_1 \\ \tilde{F}_2 \\ \tilde{F}_3 \end{Bmatrix} = \begin{bmatrix} K_{11} & K_{12} \\ K_{21} & K_{22}^1 + K_{22}^2 & K_{23}^2 \\ K_{32}^2 & K_{33}^2 \end{bmatrix} \begin{Bmatrix} \Delta_1 \\ \Delta_2 \\ \Delta_3 \end{Bmatrix} + \begin{Bmatrix} F_{EF1} \\ F_{EF2}^1 + F_{EF2}^2 \\ F_{EF3}^2 \end{Bmatrix}$$

$$\begin{Bmatrix} F_2 \\ F_3 \end{Bmatrix} = \begin{bmatrix} K_{22}^1 + K_{22}^2 & K_{23}^2 \\ K_{32}^2 & K_{33}^2 \end{bmatrix} \begin{Bmatrix} \Delta_2 \\ \Delta_3 \end{Bmatrix} + \begin{Bmatrix} F_{EF2}^1 + F_{EF2}^2 \\ F_{EF3}^2 \end{Bmatrix}$$



DATE: / /

SUB: _____

$$\begin{array}{c}
 \begin{array}{c}
 \nearrow R_{x2} \\
 \downarrow R_{y2} \\
 \textcircled{PL} \\
 \nearrow R_{x3} \\
 \textcircled{-3P} \\
 \downarrow R_{y3} \\
 M_{z3}
 \end{array}
 \end{array}
 =
 \begin{array}{c}
 \begin{array}{ccc}
 2EA & 0 & 0 \\
 \hline L & &
 \end{array}
 \begin{array}{ccc}
 0 & 0 & 0 \\
 \hline
 \end{array}
 \begin{array}{ccc}
 -EA & 0 & 0 \\
 \hline L & &
 \end{array}
 \begin{array}{ccc}
 0 & 0 & 0 \\
 \hline
 \end{array}
 \end{array}
 +
 \begin{array}{c}
 \begin{array}{c}
 \nearrow \Delta x_2 \\
 \downarrow \Delta y_2 \\
 \textcircled{\theta_2} \\
 \nearrow \Delta x_3 \\
 \textcircled{\Delta y_3} \\
 \downarrow \theta_3
 \end{array}
 \end{array}$$

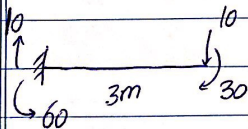
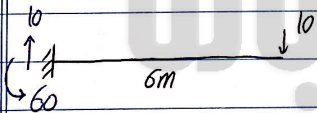
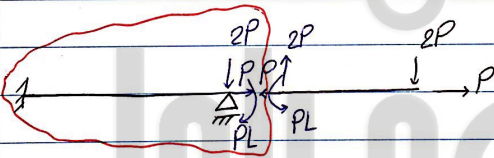
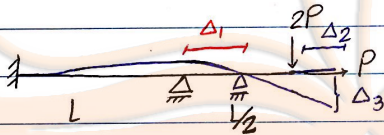
$$\begin{array}{c}
 0 \\
 \frac{P}{2} + P \\
 \textcircled{\frac{-PL}{8} + \frac{2PL}{8}} \\
 0 \\
 \textcircled{P} \\
 \frac{-2PL}{8}
 \end{array}$$

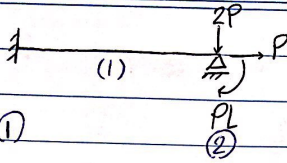
$$\begin{array}{c}
 PL \\
 -3P
 \end{array}
 =
 \begin{array}{c}
 \frac{8EI}{L} \\
 -\frac{6EI}{L^2} \\
 -\frac{6EI}{L^2} \\
 \frac{12EI}{L^3}
 \end{array}
 \begin{array}{c}
 \theta_2 \\
 \Delta y_3
 \end{array}
 +
 \begin{array}{c}
 \frac{PL}{8} \\
 P
 \end{array}$$

$$\begin{Bmatrix} \theta_2 \\ \Delta y_3 \end{Bmatrix} = \frac{1}{EI} \begin{bmatrix} \frac{96}{L^4} & -\frac{36}{L^4} \\ \frac{6}{L^4} & \frac{8}{L} \end{bmatrix} \begin{Bmatrix} \frac{12}{L^3} & \frac{6}{L^2} \\ PL & -\frac{PL}{8} \end{Bmatrix}$$

$$\begin{Bmatrix} \theta_2 \\ \Delta y_3 \end{Bmatrix} = \frac{P}{EI} \begin{Bmatrix} \frac{9L^2}{40} \\ \frac{L^3}{48} \end{Bmatrix}$$

$$R_{y2} = \begin{bmatrix} 0 & -12EI \\ & L^3 \end{bmatrix} \begin{Bmatrix} \frac{9LP}{40EI} \\ \frac{PL^3}{48EI} \end{Bmatrix} + \begin{Bmatrix} 3P \\ L^2 \end{Bmatrix} = \frac{5P}{4}$$





$$\underline{F} = \underline{K} \underline{\Delta} + \underline{FEF}$$

$$\begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} = \begin{bmatrix} \cancel{k_{11}} & k_{12} \\ k_{21} & \cancel{k_{22}} \end{bmatrix} \begin{Bmatrix} \cancel{\Delta_1} \\ \Delta_2 \end{Bmatrix}$$

$$\{F_2\} = [k_{22}] \{\Delta_2\}$$

$$\begin{Bmatrix} P \\ R_{y2} - 2P \\ -PL \end{Bmatrix} = \begin{bmatrix} \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{-6EI}{L^2} \\ 0 & \frac{-6EI}{L^2} & \frac{4EI}{L} \end{bmatrix} \begin{Bmatrix} \Delta x_2 \\ \Delta y_2 \\ \theta_2 \end{Bmatrix}$$

$$\begin{Bmatrix} P \\ -PL \end{Bmatrix} = \begin{bmatrix} \frac{EA}{L} & 0 \\ 0 & \frac{4EI}{L} \end{bmatrix} \begin{Bmatrix} \Delta x_2 \\ \theta_2 \end{Bmatrix}$$

$$P = \frac{EA}{L} \times \Delta x_2$$

$$\Delta x_2 = \frac{PL}{EA}$$

$$-PL = \frac{4EI}{L} \theta_2$$

$$\theta_2 = \frac{-PL^2}{4EI}$$

$$R_{y2} - 2P = 0 \times \Delta x_2 + \frac{12EI}{L^3} \times 0 + \frac{-6EI}{L^2} \times \theta_2 = \frac{-6EI}{L^2} \times \frac{-PL^2}{4EI} = \frac{3P}{2}$$

$$\Rightarrow R_{y2} = \frac{7P}{2}$$

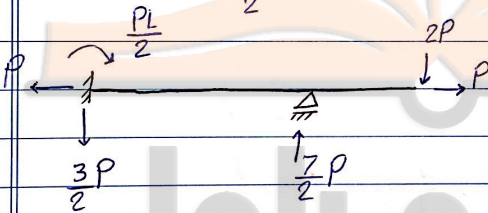
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$$\{F_i\} = [K_i] \{A_i\} \rightarrow$$

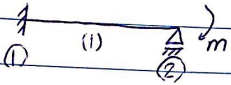
$$\begin{Bmatrix} R_{x1} \\ R_{y1} \\ M_{z1} \end{Bmatrix} = \begin{bmatrix} -EA & 0 & 0 \\ 0 & -12EA & 6EI \\ 0 & -6EI & 2EI \end{bmatrix} \begin{Bmatrix} \frac{PL}{EA} \\ 0 \\ -\frac{PL^2}{4EI} \end{Bmatrix}$$

$$\begin{Bmatrix} R_{x1} \\ R_{y1} \\ M_{z1} \end{Bmatrix} = \begin{Bmatrix} P \\ -\frac{3P}{2} \\ -\frac{PL}{2} \end{Bmatrix}$$



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$$\tilde{F} = \tilde{K} \tilde{\Delta} + \tilde{F}_{EF}$$

$$\begin{bmatrix} \tilde{F}_1 \\ \tilde{F}_2 \end{bmatrix} = \begin{bmatrix} k_{11} & k_{12} \\ k_{21} & k_{22} \end{bmatrix} \begin{bmatrix} \tilde{\Delta}_1 \\ \tilde{\Delta}_2 \end{bmatrix}$$

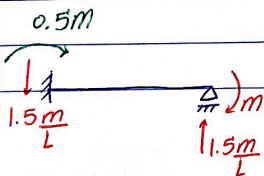
$$\begin{bmatrix} \cancel{F_{x2}} \\ R_{y2} \\ \cancel{F_{y2}} \\ \cancel{M_{z2}} \end{bmatrix} = \begin{bmatrix} \cancel{EA/L} & 0 & 0 \\ 0 & 12EA/L^3 & -6EI/L^2 \\ 0 & -6EI/L^2 & 4EI/L \end{bmatrix} \begin{bmatrix} \cancel{\Delta_{2x}} \\ \Delta_{2y} \\ \theta_2 \end{bmatrix}$$

$$0 = \frac{EA}{L} \times \Delta_{2x} + 0 \times \Delta_{2y} + 0 \times \theta_2 \Rightarrow \Delta_{2x} = 0$$

$$-m = \frac{4EI}{L} \theta_2 \Rightarrow \theta_2 = \frac{-mL}{4EI}$$

$$R_{y2} = \frac{-6EI}{L^2} \theta_2 = \frac{-6EI}{L^2} \times \frac{-mL}{4EI} = \frac{1.5m}{L}$$

$$R_{y2} = \frac{1.5m}{L}$$

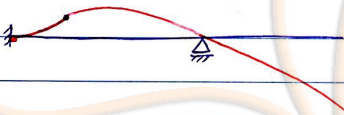
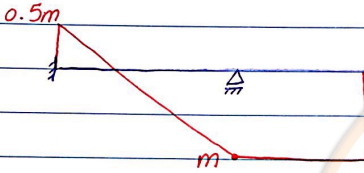
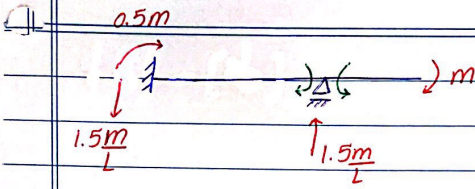


$$\sum M_A = 0 \Rightarrow m - \frac{1.5m}{L} \times L =$$

$$m - 1.5m = -0.5m$$

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سازه مقابل را با استفاده از روش توزیع لنگر تحلیل کرده و لنگرهای انتقالی اعضای بدست آمده

$$M_{BC} = -730 \text{ kg}\cdot\text{m} \quad M_{BA} = 730 \text{ kg}\cdot\text{m} \quad M_{AB} = 863 \text{ kg}\cdot\text{m}$$

به قرار زیر است: فقط دیاگرام لنگر خمشی و صحنی الاستیک آن را رسم کنید.

