FEM

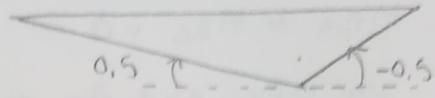
$$BA = \frac{3PL}{16} = \frac{3(15)(14)}{16} = 39,375$$

$$BC = \frac{-11\,WL^2}{192} = \frac{-11(3)(12)^2}{192} = -24,75$$

$$CB = \frac{5\,WL^2}{192} = \frac{5(3)(12)^2}{192} = 11,25$$

$$CD = \frac{-WL^2}{30} = \frac{-1,5(14)^2}{30} = -9,8$$

$$DC = \frac{WL^2}{20} = \frac{1,5(14)^2}{20} = 14,7$$



$$\Psi_{BC} = 0,5\,|\,12(12) = 0,003472$$

$$\Psi_{CD} = -0,5\,|\,14(12) = -0,002976$$

$$EI_1 = \frac{29000(800)}{12^2} = 161\,111,111$$

$$EI_2 = \frac{2900(1600)}{12^2} = 322\,222,222$$

MOMENTOS

$$M_{BA} = 34\,523,809(\theta_B) + 39,375 = 34\,523,809\,\theta_B + 39,375$$

$$M_{BA} = \boxed{157,52\ K\cdot ft}$$

$$M_{BC} = 53\,703,704(2\theta_B + \theta_C - 0,010416) - 24,75$$

$$M_{BC} = 107\,407,408\theta_B + 53\,703,704\,\theta_C - 584,128 = \boxed{-157,56\ K\cdot ft}$$

$$M_{CB} = 53\,703,704(2\theta_C + \theta_B - 0,010416) + 11,25$$

$$M_{CB} = 107\,407,408\,\theta_C + 53\,703,704\,\theta_B - 548,128 = \boxed{-246,313\ K\cdot ft}$$

$$M_{CD} = 23015,873(2\theta_C + 0,008928) - 9,8$$

$$M_{CD} = 46\,031,746\,\theta_C + 195,686 = \boxed{246,275\ K\cdot ft}$$

$$M_{DC} = 23015,873(\theta_C + 0,008928) + 14,7$$

$$M_{DC} = 23\,015,873\,\theta_C + 220,186 = \boxed{245,48\ K\cdot ft}$$

ECUACIONES

$M_{BA} + M_{BC} = 0$

$34\,523,809\,\theta_B + 39,375 + 107\,407,408\,\theta_B + 53\,703,704\,\theta_C - 584,128 = 0$

$141\,931,217\,\theta_B + 53\,703,704\,\theta_C = 544,753$

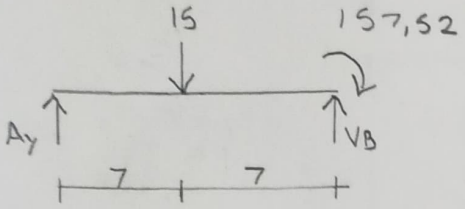
$M_{CB} + M_{CD} = 0$

$107\,407,408\,\theta_C + 53\,703,704\,\theta_B - 548,128 + 46\,031,746\,\theta_C + 195,686 = 0$

$53\,703,704\,\theta_B + 153\,439,154\,\theta_C = 352,442$

$\theta_B = 0,003422$ $\qquad$ $\theta_C = 0,001099$

REACIONES



$\circlearrowright + \Sigma M_B = 0$

$157,52 - 15(7) + 14A_y = 0$

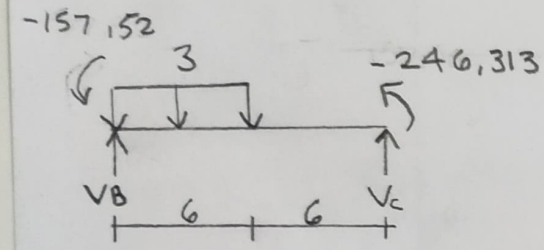
$\boxed{A_y = -3,75 \text{ K} \downarrow}$

$\Sigma f_y = 0$

$-3,75 - 15 + V_B = 0$

$\boxed{V_B = 18,75 \text{ K} \uparrow}$

$\boxed{B_y = 65,9 \text{ K} \uparrow}$



$\circlearrowright + \Sigma M_C = 0$

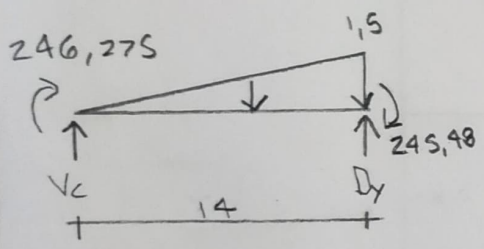
$-157,52 - 246,313 - 9(3)(6) + 12V_B = 0$

$\boxed{V_B = 47,15 \text{ K} \uparrow}$

$\Sigma f_y = 0$

$47,15 - 3(6) + V_C = 0$

$\boxed{V_C = -29,15 \text{ K} \downarrow}$



$\circlearrowright + \Sigma M_C = 0$

$246,275 + 245,98 + \frac{1,5(14)}{2}(9,33) - 14D_y = 0$

$\boxed{D_y = 42,12 \text{ K} \uparrow}$

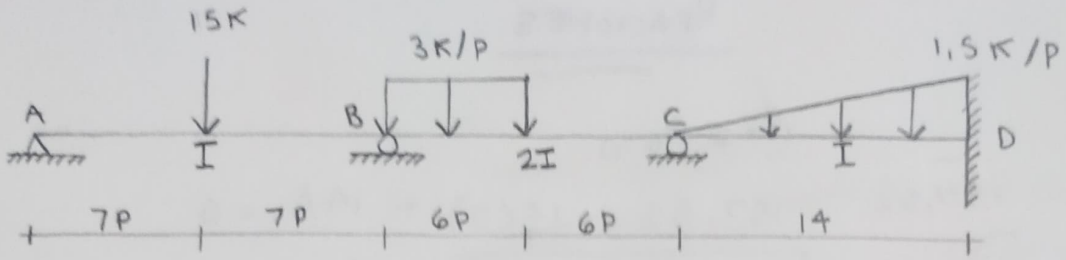
$\boxed{C_y = -60,77 \text{ K} \downarrow}$

$\Sigma f_y = 0$

$V_C - \frac{1,5(14)}{2} + 42,12 = 0$

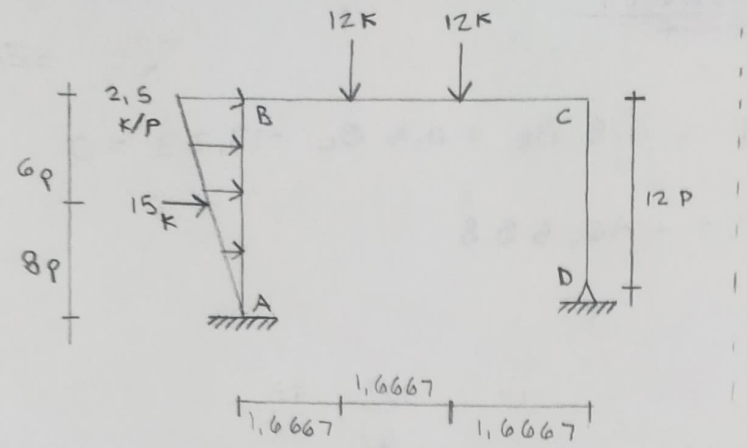
$\boxed{V_C = -31,62 \text{ K} \downarrow}$

$B_y =$



V

M



FEM

$$AB = -\frac{WL^2}{30} - \frac{Pb^2a}{L^2} = -\frac{2,5(14)^2}{30} - \frac{15(6)^2(8)}{14^2} = -38,374$$

$$BA = \frac{WL^2}{20} + \frac{Pa^2b}{L^2} = \frac{2,5(14)^2}{20} + \frac{15(8)^2(6)}{14^2} = 53,888$$

$$BC = -\frac{2PL}{9} = \frac{-2(12)(5)}{9} = -13,33$$

$$CB = 13,33$$

MOMENTOS

$$M_{AB} = 0,1429EI(\theta_B - 0,21429\Delta) - 38,374 = 0,1429\theta_B - 0,0306\Delta - 38,37$$

$$M_{AB} = \boxed{-215,13\ K\cdot ft}$$

$$M_{BA} = 0,1429EI(2\theta_B - 0,21429\Delta) + 53,888 = 0,2858\theta_B - 0,0306\Delta + 53,888$$

$$M_{BA} = \boxed{-106,37\ K\cdot ft}$$

$$M_{BC} = 0,4EI(2\theta_B + \theta_C) - 13,33 = 0,8\theta_B + 0,4\theta_C - 13,33$$

$$M_{BC} = \boxed{106,37\ K\cdot ft}$$

$$M_{CB} = 0,4EI(2\theta_C + \theta_B) + 13,33 = 0,8\theta_C + 0,4\theta_B + 13,33$$

$$M_{CB} = \boxed{114,25\ K\cdot ft}$$

$$M_{CD} = 0,25EI(\theta_C - 0,08333\Delta) = 0,25\theta_C - 0,0208\Delta$$

$$M_{CD} = \boxed{-114,25\ K\cdot ft}$$

ECUACIONES

$M_{BA} + M_{BC} = 0$

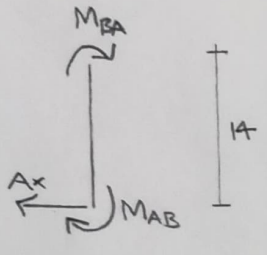
$0,2858\,\theta_B - 0,0306\,\Delta + 53,888 + 0,8\,\theta_B + 0,4\,\theta_C - 13,33 = 0$

$1,0858\,\theta_B + 0,4\,\theta_C - 0,0306\,\Delta = -40,558$

$M_{CB} + M_{CD} = 0$

$0,8\theta_C + 0,4\,\theta_B + 13,33 + 0,25\,\theta_C - 0,0208\,\Delta = 0$

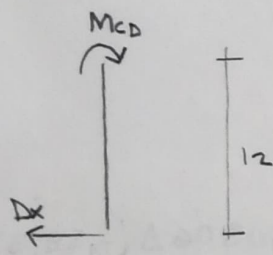
$0,4\,\theta_B + 1,05\,\theta_C - 0,0208\,\Delta = -13,33$



$\circlearrowright \Sigma M_B = 0$

$M_{AB} + M_{BA} + 14A_x = 0$

$A_x = \dfrac{-M_{AB} - M_{BA}}{14} = \dfrac{215,13 + 106,37}{14} = \boxed{22,96\ K \leftarrow}$



$\circlearrowright \Sigma M_C = 0$

$M_{CD} + 12D_x = 0$

$D_x = \dfrac{-M_{CD}}{12} = \dfrac{114,25}{12} = \boxed{9,52\ K \leftarrow}$

$\overset{+}{\rightarrow} \Sigma F_x = 0$

$17,5 + 15 - A_x - D_x = 0$

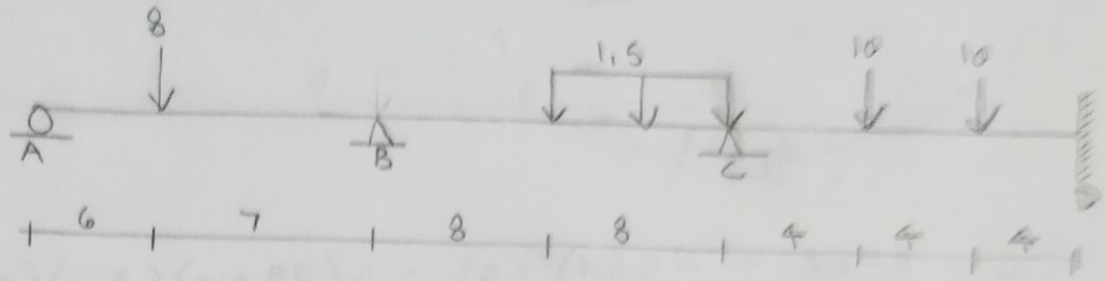
$32,5 + \dfrac{M_{AB} + M_{BA}}{14} + \dfrac{M_{CD}}{12} = 0$

$455 + 0,1429\,\theta_B - 0,0306\,\Delta - 38,374 + 0,2858\,\theta_B - 0,0306\,\Delta + 53,888$

$+ 0,2917\,\theta_C - 0,0243\,\Delta = 0$

$0,4287\,\theta_B + 0,2917\,\theta_C - 0,0855\,\Delta = -470,514$

PROBLEMA # 1



F.R

$$R_{AB} = \frac{3EI}{L} = \frac{3}{13} = 0,2308$$

$$R_{BC} = \frac{4EI}{L} = \frac{4}{16} = 0,25$$

$$R_{CD} = \frac{4EI}{L} = \frac{4}{12} = 0,3333$$

F.D

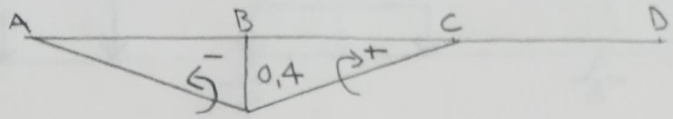
$$D_{BA} = \frac{R_{AB}}{R_{AB}+R_{BC}} = \frac{0,2308}{0,2308+0,25} = 0,48$$

$$D_{BC} = \frac{R_{BC}}{R_{AB}+R_{BC}} = \frac{0,25}{0,2308+0,25} = 0,52$$

$$D_{CB} = \frac{R_{BC}}{R_{BC}+R_{CD}} = \frac{0,25}{0,25+0,3333} = 0,43$$

$$D_{CD} = \frac{R_{CD}}{R_{BC}+R_{CD}} = \frac{0,3333}{0,25+0,3333} = 0,57$$

FEM



$$AB = -\frac{Pb^2a}{L^2} - \frac{6EI\Delta}{L^2} = \frac{-8(7)^2(6)}{13^2} - \frac{6(29000)(800)(0,4)}{13^2\,(12)^3}$$

$$AB = -13,92 - 190,66 = \boxed{-204,58}$$

$$BA = \frac{Pa^2b}{L^2} - \frac{6EI\Delta}{L^2} = \frac{8(6)^2(7)}{13^2} - \frac{6(29000)(800)(0,4)}{13^2\,(12)^3}$$

$$BA = 11,93 - 190,66 = \boxed{-178,73}$$

$$BC = -\frac{5WL^2}{192} + \frac{6EI\Delta}{L^2} = -\frac{5(1,5)(16)^2}{192} + \frac{6(29000)(800)(0,4)}{16^2\,(12)^3}$$

$$BC = -10 + 125,87 = \boxed{115,87}$$

$$CB = \frac{11WL^2}{192} + \frac{6EI\Delta}{L^2} = \frac{11(1,5)(16)^2}{192} + \frac{6(29000)(800)(0,4)}{16^2\,(12)^3}$$

$$CB = 22 + 125,87 = \boxed{147,87}$$

$$CD = -\frac{2PL}{9} = -\frac{2(10)(12)}{9} = \boxed{-26,67}$$

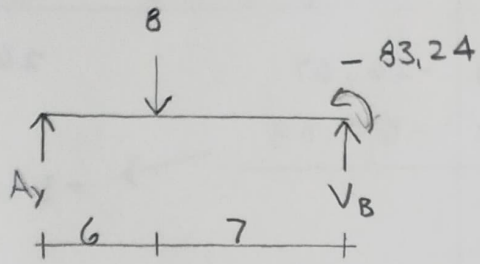
$$DC = 26,67$$

A	B		C		D
	0,48	0,52	0,43	0,57	
		← ½ →		← ½ →	
-204,58					
204,58	-178,73	115,87	147,87	-26,67	26,67
	30,17	32,69	-52,12	-69,08	→ -34,54
	102,29	-26,06	16,34		
	-36,59	-39,64	-7,03	-9,31	→ -4,65
		-3,51	-19,82		
	1,68	1,82	8,52	11,3	→ 5,65
		4,26	0,91		
	-2,04	-2,21	-0,39	-0,52	→ -0,26
		-0,19	-1,1		
	0,09	0,1	0,47	0,63	→ 0,31
		0,23	0,05		
	-0,11	-0,12	-0,02	-0,03	

$M_{AB} = 0$ $\quad M_{BC} = 83,24$ K·ft $\quad M_{CD} = -93,68$ K·ft

$M_{BA} = -83,24$ K·ft $\quad M_{CB} = 93,68$ K·ft $\quad M_{DC} = -6,82$ K·ft

REACCIONES



$\overset{\curvearrowright}{+}\Sigma M_B = 0$

$-83,24 - 8(7) + 13A_y = 0$

$A_y = 10,71\ K \uparrow$

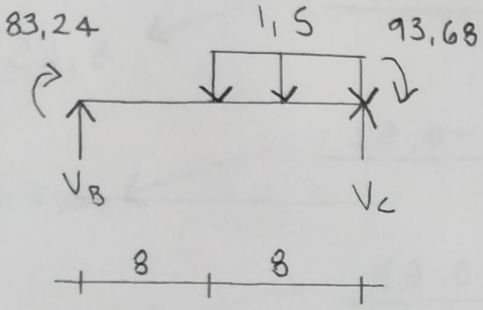
$\Sigma F_y = 0$

$10,71 + V_B - 8 = 0$

$V_B = -2,71 \downarrow$

$B_y = -2,71 - 8,06$

$B_y = -10,77\ K \downarrow$



$\overset{\curvearrowright}{+}\Sigma M_C = 0$

$83,24 + 93,68 - 1,5(8)(4) + 16V_B = 0$

$V_B = -8,06 \downarrow$

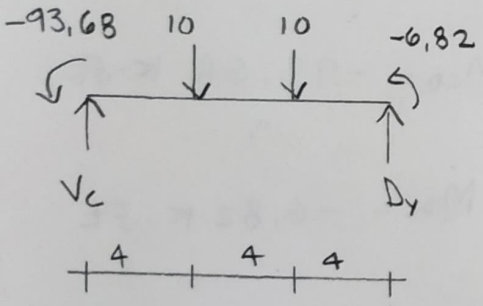
$\Sigma F_y = 0$

$-1,5(8) - 8,06 + V_C = 0$

$V_C = 20,06 \uparrow$

$C_y = 20,06 + 18,37$

$C_y = 38,43\ K \uparrow$



$\overset{\curvearrowright}{+}\Sigma M_D = 0$

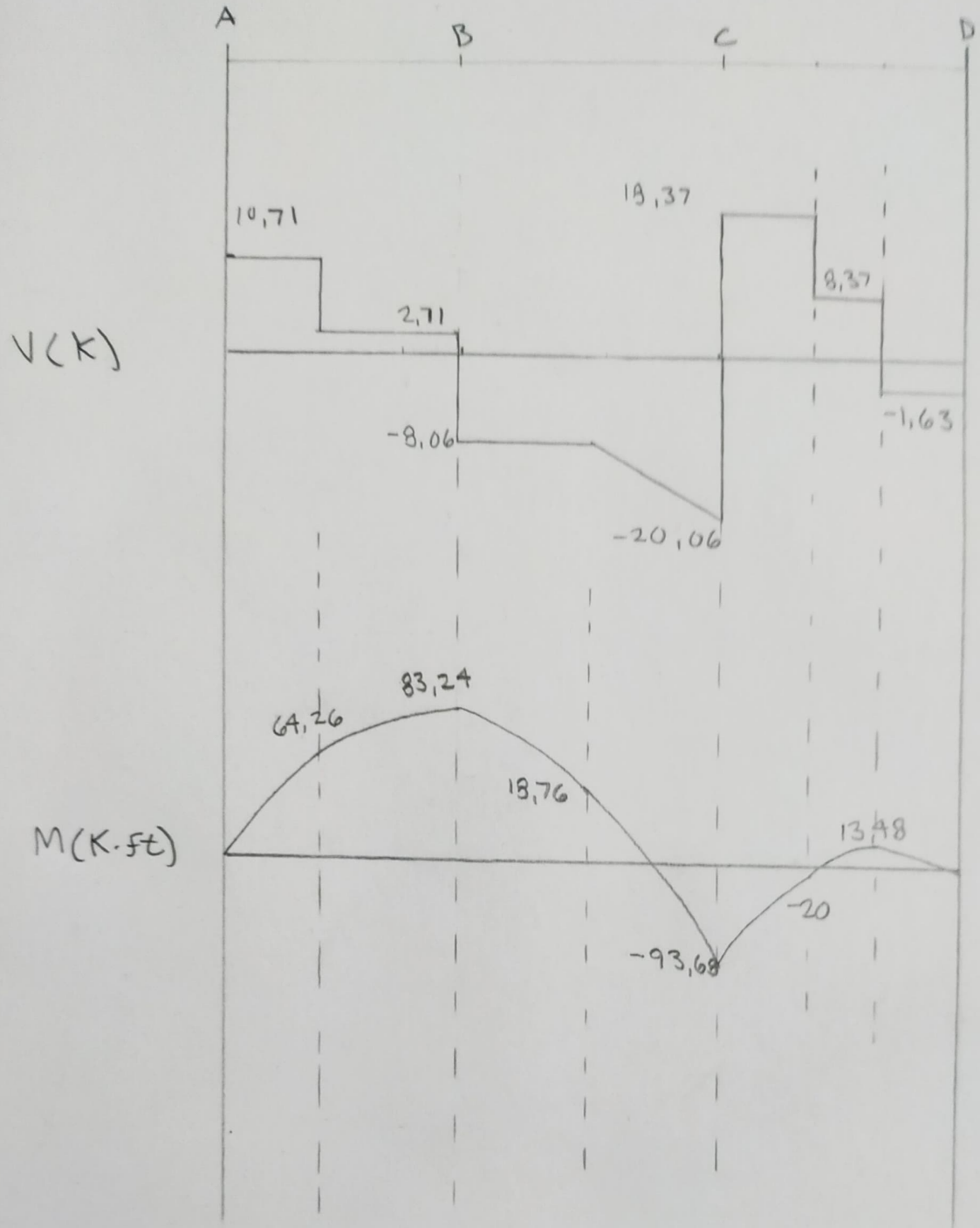
$-6,82 - 93,68 - 10(4) - 10(8) + 12V_C = 0$

$V_C = 18,37 \uparrow$

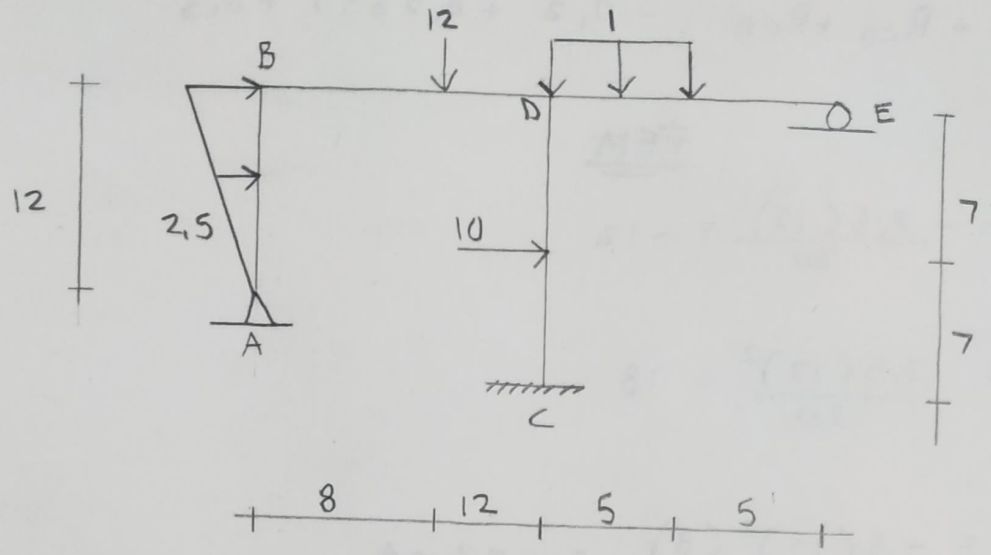
$\Sigma F_y = 0$

$18,37 - 20 + D_y = 0$

$D_y = 1,63\ K \uparrow$


A
B
C
D
V(K)
10,71
2,71
-8,06
-20,06
18,37
8,37
-1,63
M(K.ft)
64,26
83,24
18,76
-93,68
-20
13,48

PROBLEMA #2



$$R_{AB} = \frac{3EI}{L} = \frac{3}{12} = 0,25$$

$$R_{BD} = \frac{4EI}{L} = \frac{4}{20} = 0,2$$

$$R_{CD} = \frac{4EI}{14} = \frac{4}{14} = 0,2857$$

$$R_{DE} = \frac{3EI}{L} = \frac{3}{10} = 0,3$$

F.D

$$D_{BA} = \frac{R_{AB}}{R_{AB} + R_{BD}} = \frac{0,25}{0,25 + 0,2} = 0,56$$

$$D_{BD} = \frac{R_{BD}}{R_{AB} + R_{BD}} = \frac{0,2}{0,25 + 0,2} = 0,44$$

$$D_{DB} = \frac{R_{BD}}{R_{BD} + R_{CD} + R_{DE}} = \frac{0,2}{0,2 + 0,2857 + 0,3} = 0,26$$

$$D_{DC} = \frac{R_{CD}}{R_{BD} + R_{CD} + R_{DE}} = \frac{0,2857}{0,2 + 0,2857 + 0,3} = 0,36$$

$$D_{DE} = \frac{R_{DE}}{R_{BD} + R_{CD} + R_{CE}} = \frac{0,3}{0,2 + 0,2857 + 0,3} = 0,38$$

FEM

$$AB = \frac{-WL^2}{30} = -\frac{2,5(12)^2}{30} = -12$$

$$BA = \frac{WL^2}{20} = \frac{2,5(12)^2}{20} = 18$$

$$BD = \frac{-Pb^2a}{L^2} = \frac{-8(12)^2(8)}{20^2} = -23,04$$

$$DB = \frac{Pa^2b}{L^2} = \frac{8(8)^2(12)}{20^2} = 15,36$$

$$CD = -\frac{PL}{8} = -\frac{10(14)}{8} = -17,5$$

$$DC = 17,5$$

$$DE = \frac{-11WL^2}{192} = \frac{-11(1)(10)^2}{192} = -5,73$$

$$ED = \frac{5WL^2}{192} = \frac{5(1)(10)^2}{192} = 2,6$$

$M_{AB} = 0$

$M_{BA} = 25,43$

$M_{BD} = -25,44$

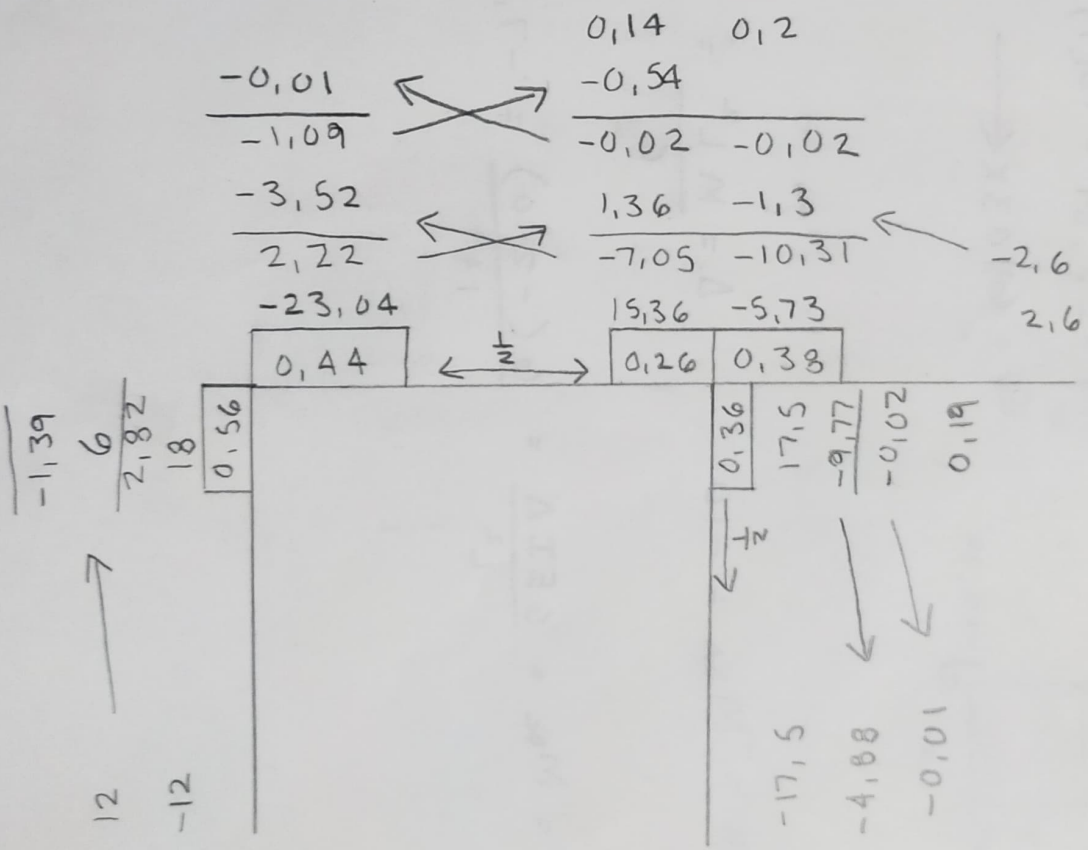
$M_{DB} = 9,25$

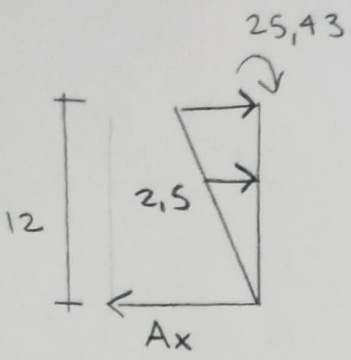
$M_{DE} = -17,16$

$M_{ED} = 0$

$M_{DC} = 7,9$

$M_{CD} = -22,39$



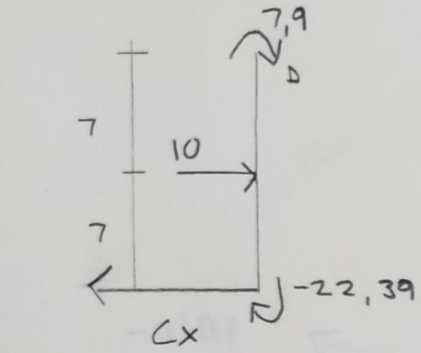


$\circlearrowleft + \Sigma M_B = 0$

$25,43 - \frac{2,5(12)}{2}(4) + 12A_x = 0$

$A_x = 2,88\ K \leftarrow$

$R_1 = -2,88 + 15 + 10 + 6,03 = 16,09$



$\circlearrowleft + \Sigma M_D = 0$

$7,9 - 22,39 - 10(7) + 14C_x = 0$

$C_x = 6,03K \leftarrow$

$M_{AB} = M_{BA} = -10$ $\qquad \Delta = \frac{ML^2}{6} = \frac{-10(12)^2}{6} = -240$

$M_{CD} = M_{DC} = \frac{6EI\Delta}{L^2} = \frac{6(-240)}{14^2} = -7,35$

$M_{AB} = -0,77$

$M_{BA} = -4,77$

$M_{BD} = 4,77$

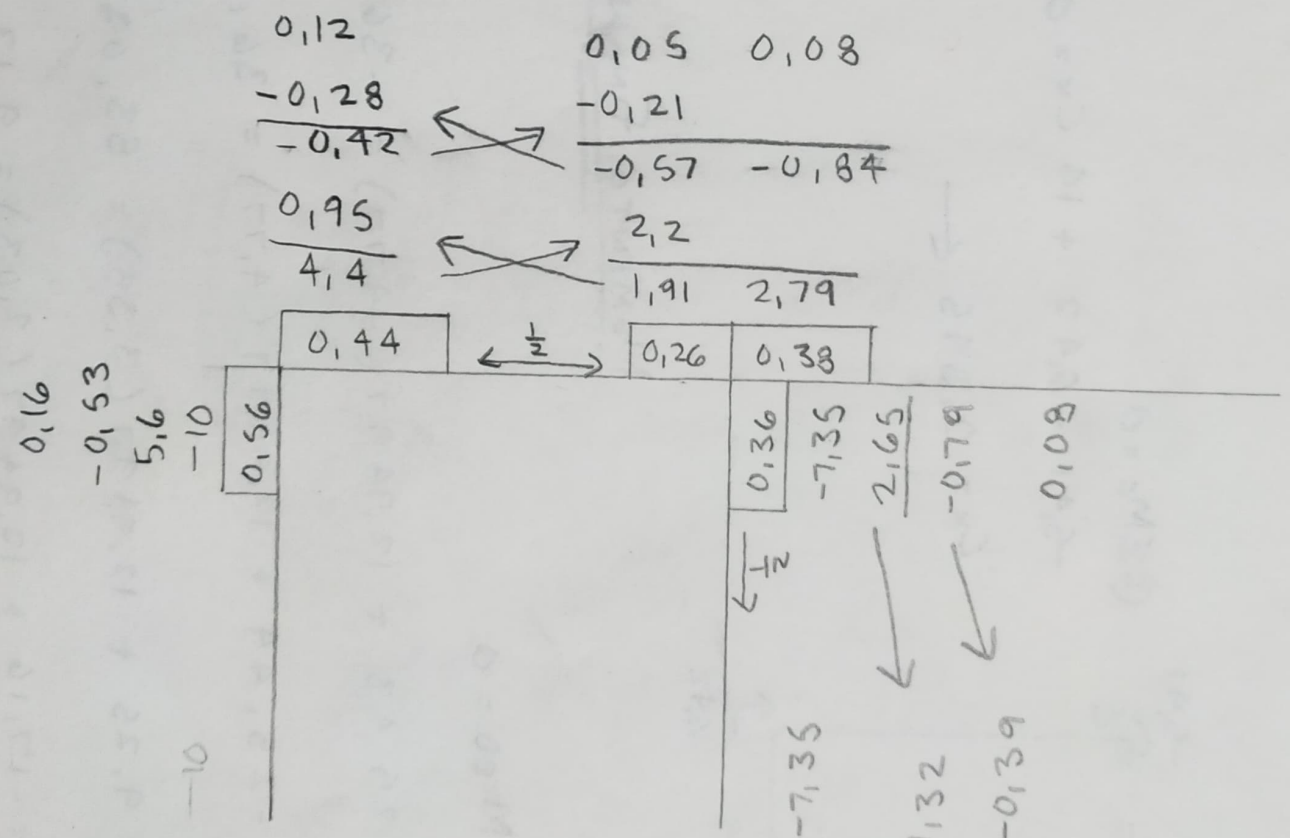
$M_{DB} = 3,38$

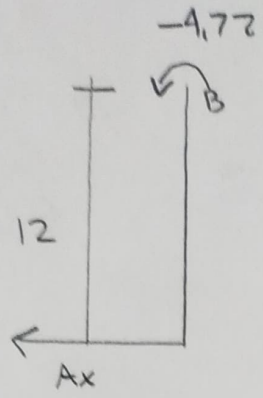
$M_{DE} = 2,03$

$M_{ED} = 0$

$M_{DC} = -5,41$

$M_{CD} = -6,42$



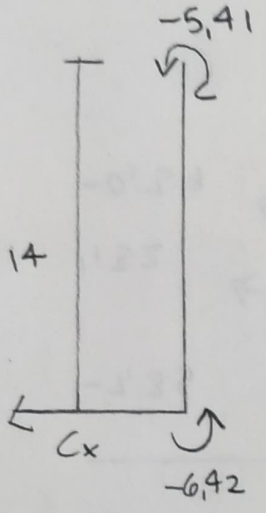


$\overset{\curvearrowright}{+}\Sigma M_B = 0$

$-4,77 + 12A_x = 0$

$A_x = 0,3975 \leftarrow$

$R_2 = 0,3975 + 0,845 = 1,2425$



$\overset{\curvearrowright}{+}\Sigma M_C = 0$

$-5,41 - 6,42 + 14\,C_x = 0$

$C_x = 0,845 \leftarrow$

Momento Finales

$M_{AB} = M_{ED} = 0$

$M_{BA} = 25,43 + 12,9497(-4,77) = -36,34$ K.ft

$M_{BD} = -25,44 + 12,9497(4,77) = 36,34$ K.ft

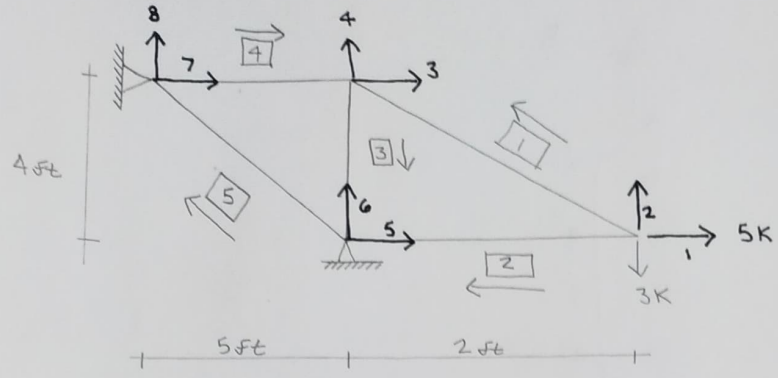
$M_{DB} = 9,25 + 12,9497(3,38) = 53,02$ K.ft

$M_{DE} = -17,16 + 12,9497(2,03) = 9,13$ K.ft

$M_{DC} = 7,9 + 12,9497(-5,41) = -62,16$ K.ft

$M_{CD} = -22,39 + 12,9497(-6,42) = -105,53$ K.ft

①



ELEMENTO 1

$$\lambda_x = \frac{-2}{4,4721} = -0,4472 \qquad \lambda_y = \frac{4}{4,4721} = 0,8944 \qquad \frac{L}{AE} = 4,4721$$

$$K_1 = \begin{array}{c} \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{bmatrix} 0,045 & -0,089 & -0,045 & 0,089 \\ -0,089 & 0,179 & 0,089 & -0,179 \\ -0,045 & 0,089 & 0,045 & -0,089 \\ 0,089 & -0,179 & -0,089 & 0,179 \end{bmatrix} \end{array} \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \end{matrix}$$

ELEMENTO 2

$$\lambda_x = \frac{-2}{2} = -1 \qquad \lambda_y = 0 \qquad \frac{L}{AE} = 2$$

$$K_2 = \begin{array}{c} \begin{matrix} 1 & 2 & 5 & 6 \end{matrix} \\ \begin{bmatrix} 0,5 & 0 & -0,5 & 0 \\ 0 & 0 & 0 & 0 \\ -0,5 & 0 & 0,5 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \begin{matrix} 1 \\ 2 \\ 5 \\ 6 \end{matrix}$$

ELEMENTO 3

$$\lambda_x = 0 \qquad \lambda_y = \frac{-4}{4} = -1 \qquad \frac{L}{AE} = 4$$

$$K_3 = \begin{array}{c} \begin{matrix} 3 & 4 & 5 & 6 \end{matrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0,25 & 0 & -0,25 \\ 0 & 0 & 0 & 0 \\ 0 & -0,25 & 0 & 0,25 \end{bmatrix} \end{array} \begin{matrix} 3 \\ 4 \\ 5 \\ 6 \end{matrix}$$

ELEMENTO 4

$$\lambda_x = \frac{5}{5} = 1 \qquad \lambda_y = 0 \qquad \frac{L}{AE} = 5$$

$$K_4 = \begin{array}{c} \begin{matrix} 7 & 8 & 3 & 4 \end{matrix} \\ \begin{bmatrix} 0,2 & 0 & -0,2 & 0 \\ 0 & 0 & 0 & 0 \\ -0,2 & 0 & 0,2 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \begin{matrix} 7 \\ 8 \\ 3 \\ 4 \end{matrix}$$

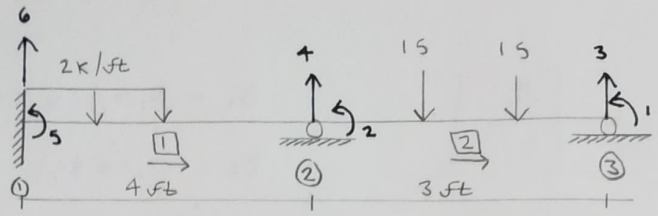
ELEMENTO 5

$$\lambda_x = \frac{4}{6,4031} = 0,6247 \qquad \lambda_y = \frac{-5}{6,4031} = -0,7809 \qquad \frac{L}{AE} = 6,403$$

$$K_5 = \begin{array}{c} \begin{matrix} 5 & 6 & 7 & 8 \end{matrix} \\ \begin{bmatrix} 0,061 & -0,076 & -0,061 & 0,076 \\ -0,076 & 0,095 & 0,076 & -0,095 \\ -0,061 & 0,076 & 0,061 & -0,076 \\ 0,076 & -0,095 & -0,076 & 0,095 \end{bmatrix} \end{array} \begin{matrix} 5 \\ 6 \\ 7 \\ 8 \end{matrix}$$

$$\begin{bmatrix} 5 \\ -3 \\ 0 \\ 0 \\ Q_5 \\ Q_6 \\ Q_7 \\ Q_8 \end{bmatrix} = \begin{array}{c} \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \end{matrix} \\ \begin{bmatrix} 0,545 & -0,089 & -0,045 & 0,089 & -0,5 & 0 & 0 & 0 \\ -0,089 & 0,179 & 0,089 & -0,179 & 0 & 0 & 0 & 0 \\ -0,045 & 0,089 & 0,245 & -0,089 & 0 & 0 & -0,2 & 0 \\ 0,089 & -0,179 & -0,089 & 0,429 & 0 & -0,25 & 0 & 0 \\ -0,5 & 0 & 0 & 0 & 0,561 & -0,076 & -0,061 & 0,076 \\ 0 & 0 & 0 & -0,25 & -0,076 & 0,345 & 0,076 & -0,095 \\ 0 & 0 & -0,2 & 0 & -0,061 & 0,076 & 0,261 & -0,076 \\ 0 & 0 & 0 & 0 & 0,076 & -0,095 & -0,076 & 0,095 \end{bmatrix} \end{array} \begin{bmatrix} D_1 \\ D_2 \\ D_3 \\ D_4 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

(2)



ELEMENTO 1

$$K_1 = \begin{array}{c} \\ 6 \\ 5 \\ 4 \\ 2 \end{array} \begin{array}{c} \begin{array}{cccc} 6 & 5 & 4 & 2 \end{array} \\ \begin{bmatrix} 0,19 & 0,38 & -0,19 & 0,38 \\ 0,38 & 1 & -0,38 & 0,5 \\ -0,19 & -0,38 & 0,19 & -0,38 \\ 0,38 & 0,5 & -0,38 & 1 \end{bmatrix} \end{array}$$

ELEMENTO 2

$$K_2 = \begin{array}{c} \\ 4 \\ 2 \\ 3 \\ 1 \end{array} \begin{array}{c} \begin{array}{cccc} 4 & 2 & 3 & 1 \end{array} \\ \begin{bmatrix} 0,44 & 0,67 & -0,44 & 0,67 \\ 0,67 & 1,33 & -0,67 & 0,67 \\ -0,44 & -0,67 & 0,44 & -0,67 \\ 0,67 & 0,67 & -0,67 & 1,33 \end{bmatrix} \end{array}$$

$$\begin{bmatrix} 0 \\ -14,1667 \\ Q_3 \\ Q_4 \\ Q_5 \\ Q_6 \end{bmatrix} = \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{bmatrix} 1,333 & 0,667 & -0,667 & 0,667 & 0 & 0 \\ 0,667 & 2,333 & -0,667 & 0,292 & 0,5 & 0,375 \\ -0,667 & -0,067 & 0,444 & -0,444 & 0 & 0 \\ 0,667 & 0,292 & -0,444 & 0,632 & -0,375 & -0,188 \\ 0 & 0,5 & 0 & -0,375 & 1 & 0,375 \\ 0 & 0,375 & 0 & -0,188 & 0,375 & 0,188 \end{bmatrix} \end{array} \begin{bmatrix} D_1 \\ D_2 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$F_{12} = \frac{-11\,WL^2}{192} = \frac{-11(2)(4)^2}{192} = -1,8333 \qquad F_{21} = \frac{5\,WL^2}{192} = \frac{5(2)(4)^2}{192} = 0,8333$$

$$F_{23} = -\frac{PL}{3} = -\frac{15(3)}{3} = -15$$

0,8333
-15

M →

-1,8333 -14,1667

12,394

15

V →

-2,606
15

$$Q_K = K_{11} D_U + K_{12} \overrightarrow{D_K}^{0}$$

$$\begin{bmatrix} 0 \\ -14,1667 \end{bmatrix} = \begin{bmatrix} 1,333 & 0,667 \\ 0,667 & 2,333 \end{bmatrix} \begin{bmatrix} D_1 \\ D_2 \end{bmatrix}$$

$D_1 = 3,541675$

$D_2 = -7,08335$

$$Q_U = K_{21} D_U + K_{22} \overrightarrow{D_K}^{0}$$

$$\begin{bmatrix} Q_3 \\ Q_4 \\ Q_5 \\ Q_6 \end{bmatrix} = \begin{bmatrix} -0,667 & -0,667 \\ 0,667 & 0,292 \\ 0 & 0,5 \\ 0 & 0,375 \end{bmatrix} \begin{bmatrix} 3,541675 \\ -7,08335 \end{bmatrix}$$

$Q_3 = 2,361$

$Q_4 = 0,295$

$Q_5 = -3,542$

$Q_6 = -2,656$

REACCIONES

$R_3 = 2,361 + 15 = 17,361 \text{ K} \uparrow$

$R_4 = 0,295 + 12,394 = 12,689 \text{ K} \uparrow$

$R_5 = 3,542 - 1,8333 = 1,7087 \text{ K.ft} \circlearrowright +$

$R_6 = 3,95 \text{ K} \uparrow$

ΣM