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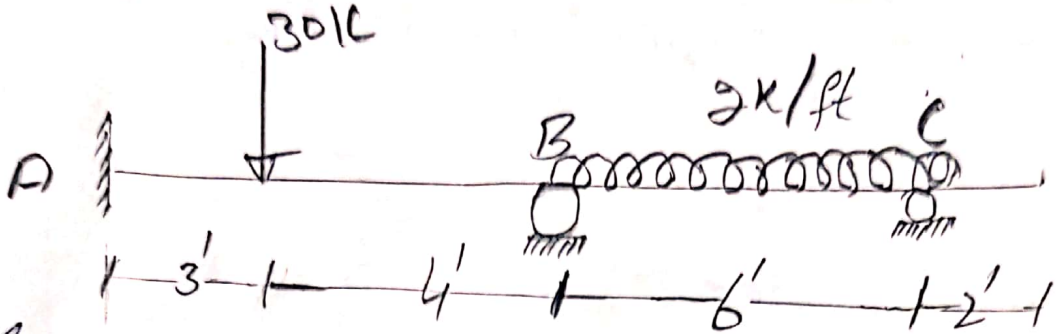
ID	7724
SECTION	(A)
SUBJECT	STRUCTURE-A-II
DATE	25/09/2020
TEACHER	Engr. Sir ADEED
EXAME	F. Term

01/01

#(01)

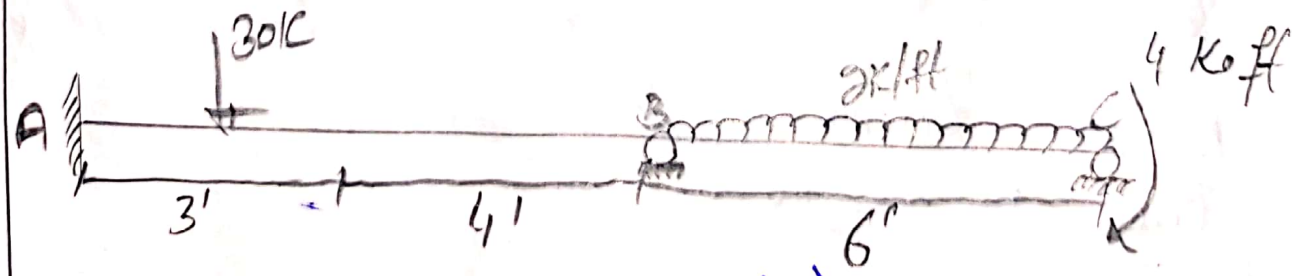


SOLUTION

#01 * Determining Kinematic Indeterminacy

∴ K.I = 5°

* ∴ we have to Reduce the Extended portion:-

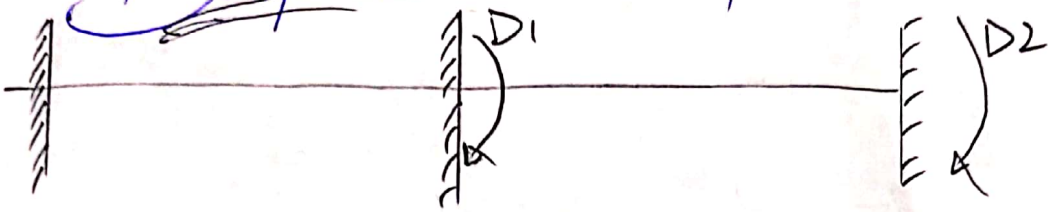


$$\frac{2(2)}{1} = 4\ K.ft$$

∴ Now:- (K.I = 2°)

NEXT STEP

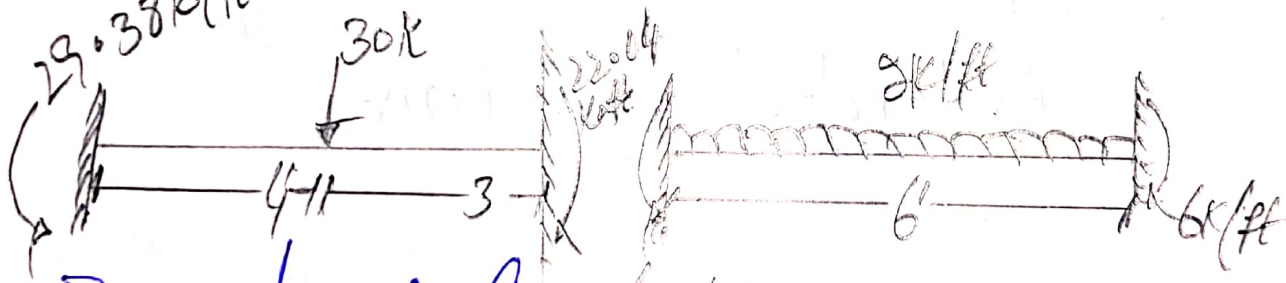
#02:- Determine Unknown Joint Displacement :-



$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} 0 \\ 4 \end{bmatrix}$$

NEXT STEP

#03:- COMPUTE [ADL] Matrix:



→ for point load (not at mid.)

→ For left End: $\frac{Pab^2}{L^2} = \frac{(30)(3)(4)^2}{(7)^2}$

29.38 K-ft

→ For Right End:

$$\frac{Pab^2}{L^2} = \frac{(30)(3)^2(4)}{(7)^2} \Rightarrow 22.04 \text{ K/ft}$$

→ For Uniformly Distributed Load:→

$$= \frac{wL^2}{12} \Rightarrow \frac{(2)(6)^2}{12} \Rightarrow 6 \text{ K-ft}$$

$$ADL_1 = +22.04 - 06 \Rightarrow 16.04 \text{ K/ft}$$

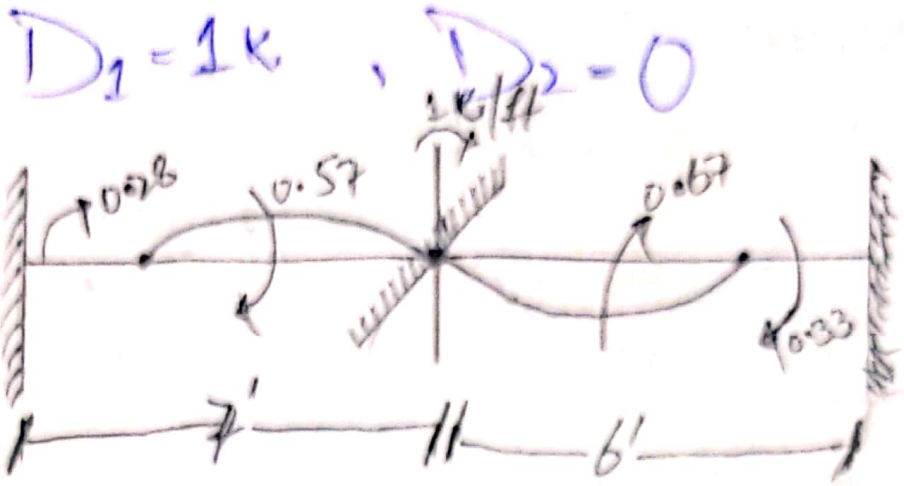
$$ADL_2 = 6 \text{ K/ft} \quad \text{Ans}$$

STEP #04: Now Compute

[S] MATRIX:→

$$S = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$$

$D_1 = 1K$, $D_2 = 0$



$$\frac{4EI}{7} = 0.57 \qquad \frac{2EI}{6} = 0.33$$

$$\frac{4EI}{6} = 0.67 \qquad \frac{2EI}{7} = 0.28$$

$$S_{11} = 0.57 + 0.67$$

$$S_{11} = 1.24EA \qquad S_{21} = 0.33EA$$

02 B07 $D_1 = 0$ $D_2 = 1K$

#01/05

$$\frac{4EI}{6} = 0.67$$

$$\frac{2EI}{6} = 0.33$$

$S_{12} = 0.33$ $S_{22} = 0.67$

$$S = \begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}$$

#05/7 NOW COMPUTE [D] MATRIX

STEP

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}^{-1} \times \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

$$= \frac{1}{\begin{bmatrix} 0.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}} \times \text{AdjAX} \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

H 01/06

$|S| = (1.24 \times 0.67) - (0.33 \times 0.33)$

$|S| = 0.8308 - 0.1089$

$\boxed{|S| = 0.7219}$

$Adj\,A = \begin{bmatrix} & \\ & \end{bmatrix}$

Now,

$$\begin{bmatrix} AD_1 - AD_1 \\ AD_2 - AD_2 \end{bmatrix} = \begin{bmatrix} 0 - 16.04 \\ 4 - 6 \end{bmatrix} = \begin{bmatrix} -16.04 \\ -2 \end{bmatrix} E$$

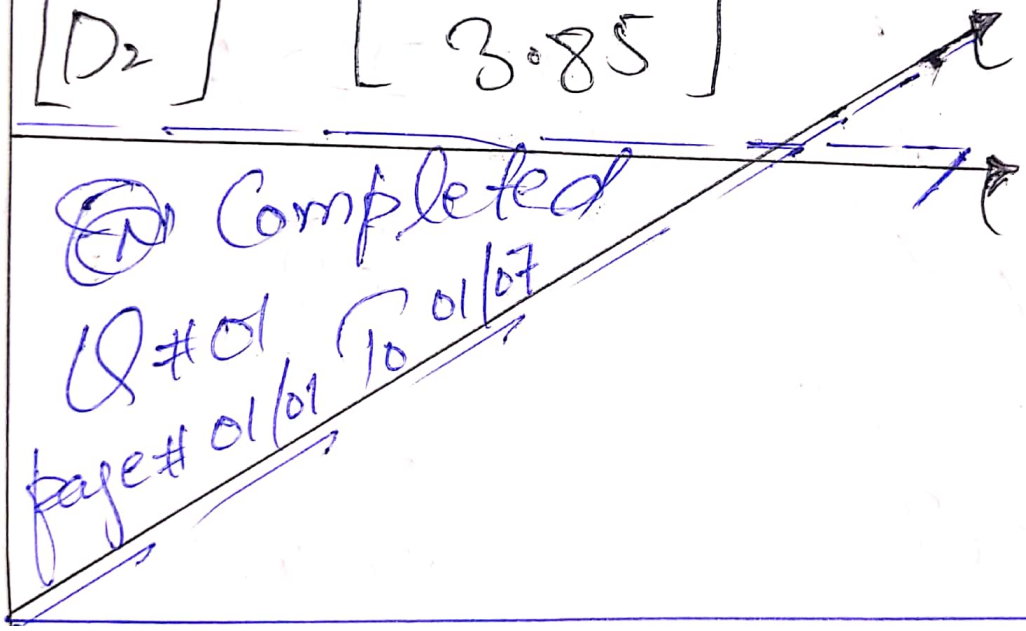
$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \frac{1}{|S|} \times Adj\,A \times \begin{bmatrix} -16.04 \\ -2 \end{bmatrix}$$

$$= \frac{\begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 1.24 \end{bmatrix}}{0.729} \times \begin{bmatrix} -16.04 \\ -2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.919 & -0.452 \\ 0.452 & 1.70 \end{bmatrix} \times \begin{bmatrix} -16.04 \\ -2 \end{bmatrix}$$

#01/07

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} -13.83 \\ 3.85 \end{bmatrix}$$



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Q#01 To 01/07
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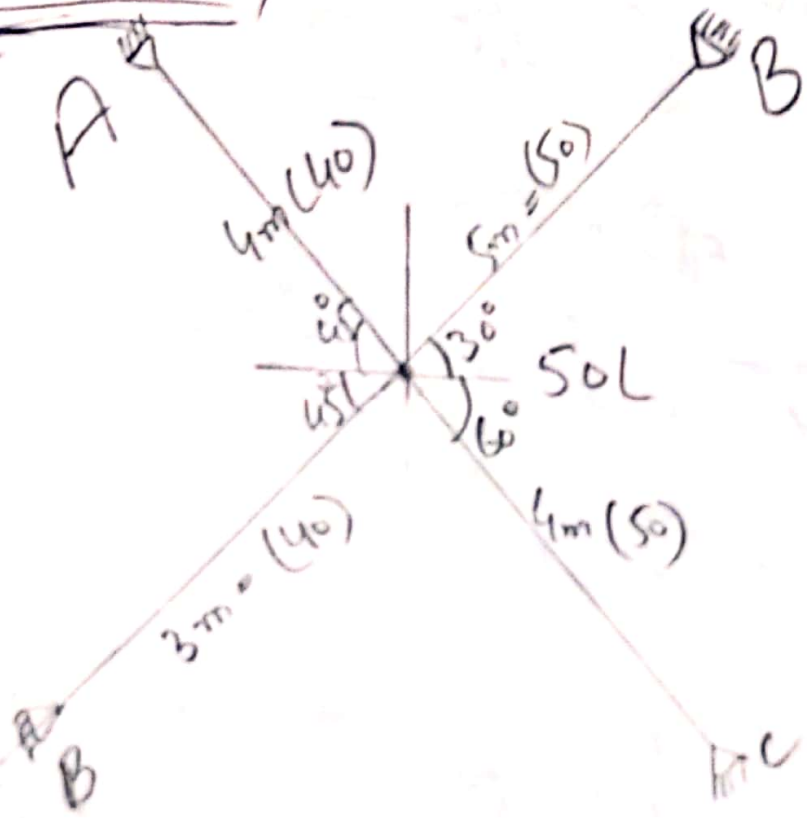
#02 / 01"

#(02)

DIAGRAMA:



E = 2050 t/m²

SOLUCIÓN:

FUERZA A

$$\sin 45^\circ = \frac{P}{H} = \frac{P}{H}$$

$$\rightarrow P = 2.828\,m$$

$$\cos 45^\circ = \frac{b}{H} = \frac{b}{H}$$

#02/02

→ $b = 2.828\,m$

FOR #B

$\sin 45 = \frac{P}{H} = \frac{P}{3}$

→ $P = 2.12m$

$\cos 45 = \frac{b}{H} = \frac{b}{3}$

→ $b = 2.12m$

FOR #C

$\sin 60 = \frac{P}{H} = \frac{P}{4}$

$(\sin 60)(4) = P$

→ $P = 3.46$

$\cos 60 = \frac{b}{H} = \frac{b}{4}$ $\cos 60 \times 4 = b$

$b = 2$

FOR #D

$\sin 30 = \frac{P}{5}$

→ $P = 2.5m$

#02(03

$\Rightarrow \cos 30 = \frac{b}{5}$

$b = 4.33\,m$

Now

$EA(A) = 2000 \times 40 = 80,000\ t$

$EA(C) = 2000 \times 50 = 80,000\ t$

$EA(D) = 2000 \times 50 = 100,000\ t$

Step #1 KI

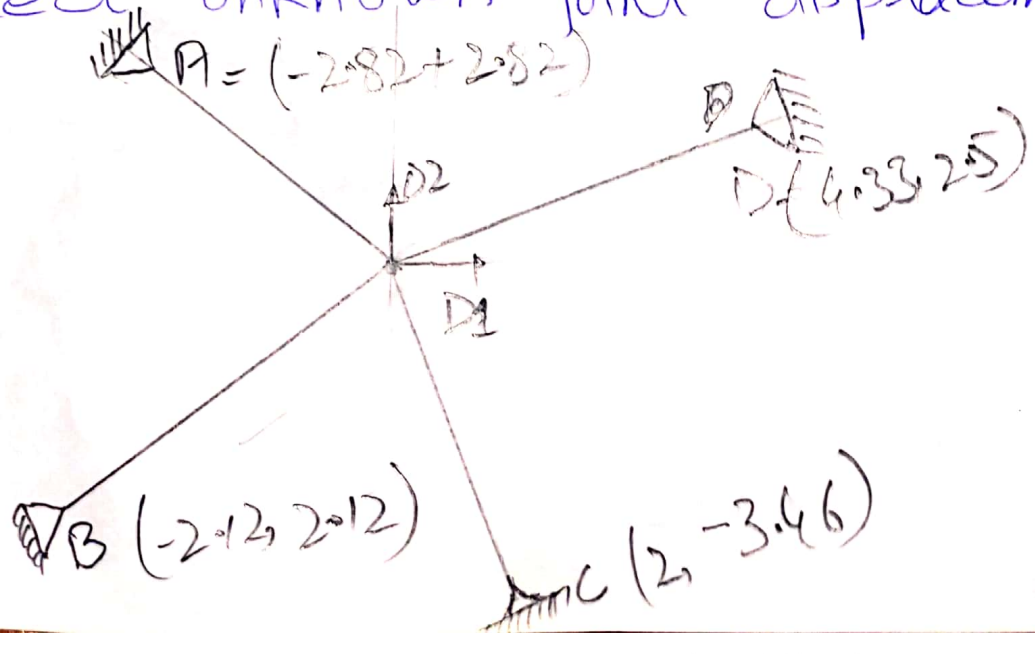
$KI = 2j - r$

$= 2(5) - 8$

$KI = 2^{\circ}$

Step #2

Select unknown joint displacement



#02/04

$D_1 = ?$ AD_1 S_0

$D_2 = ?$ AD_2 -100

#03

AMD

① $D_1 = 1K$ $D_2 = 0$

$$AMD = \frac{EA}{L^2}(X_K - X_j)$$

$$AMD_{11} = \frac{80000}{(400)^2} \times (0+282) = 141$$

$$AMD_{21} = \frac{80,000}{(300)^2} \times (0+212) = 188.41$$

$$AMD_{31} = \frac{100,000}{(500)^2} \times (0.483) = -173$$

$$AMD_{41} = \frac{100,000}{(400)^2} \times (0-200) = -12$$

~~AMD~~

$$\sum_{11} = \sum_{i=1}^{M} \frac{EA}{L^3}(xK - Xj)^2$$

#02/05

$$= \frac{80,000}{(400)^3}(282)^2 + \frac{80,000}{(300)^3} \times (212)$$

$$+ \frac{100,000}{(500)^3} \times \left(-433\right)^2 + \frac{100,000}{(400)^3} \times (-200)^2$$

$$\delta_{11} = 55.405 + 133.107 + 149.891 + 625$$

$$\delta_{11} = 445.063$$

$$\Rightarrow \delta_{12} = \delta_{21} = \sum_{I=1}^{m} \frac{EA}{L^3} \times (x_K - x_j)$$

$$(y_K - y_j)$$

$$= \frac{80,000}{(400)^3}(282)(-282) + \frac{80,000}{(300)^3}(212)$$

$$(212) + \frac{100,000}{(500)^3}(-433)(0-200) + \frac{100,000}{(400)^3}$$

$$(-200)(0-346).$$

$$\Rightarrow \delta_{12} = \delta_{21} = 12.237$$

#02/08

ii) $D_1 = 0 \quad D_2 = 1k$

$$AMD = \frac{EA}{L^2}(Yt - 1/j)$$

$$AMD_{12} = \frac{80,000}{(400)^2}(-282) = -141$$

$$AMD_{22} = \frac{80,000}{(400)^2}(212) = 188.44$$

$$AMD_{32} = \frac{100,000}{(500)^2}(-250) = -100$$

$$AMD_{42} = \frac{100,000}{(400)^3}(346) = 216.25$$

Now $S_{22} = 469.628$

Step #4: $[D] = [S]^{-1} \times [AD]$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 0.1183 \\ -0.216 \end{bmatrix}$$

#02/07

$$\begin{bmatrix} P_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 445.003 & 12.237 \\ 12.237 & 469.628 \end{bmatrix} \times \begin{bmatrix} 50 \\ -100 \end{bmatrix}$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 0.1183 \\ -0.216 \end{bmatrix}$$

#02/08

#05

$$[AM]$$

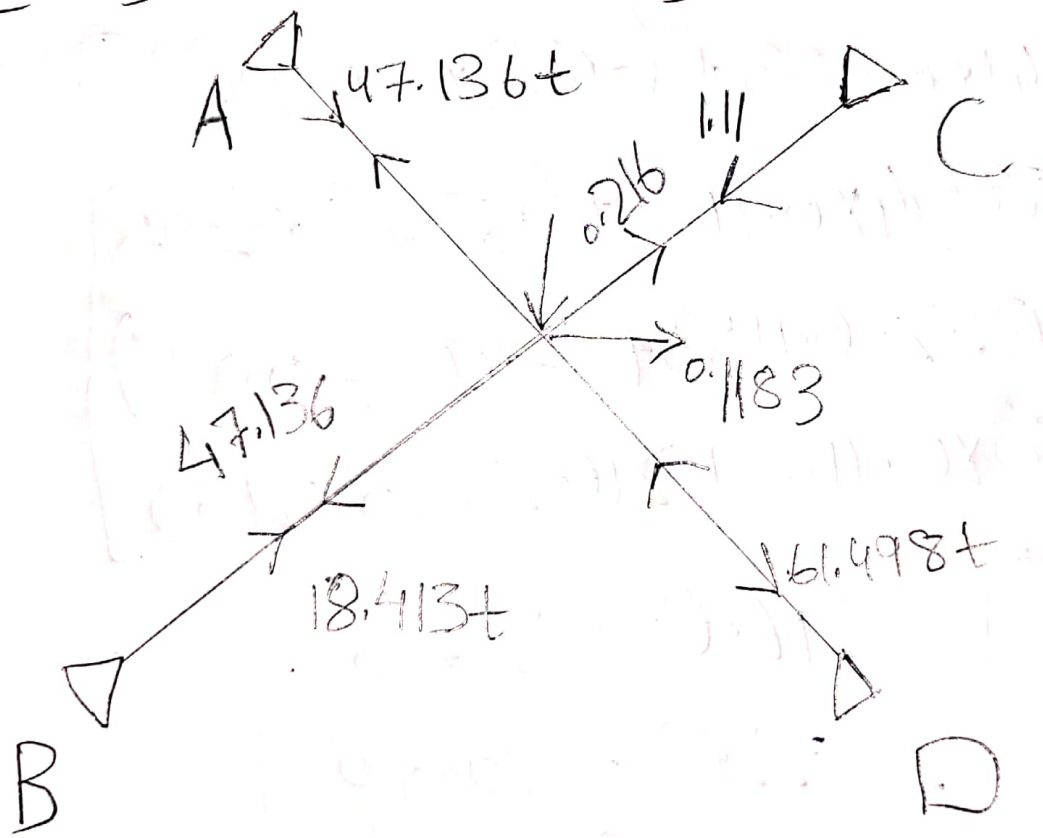
$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 141 & -141 \\ 188.44 & 188.44 \\ 173.2 & -100 \\ -125 & 216.25 \end{bmatrix} \times \begin{bmatrix} 0.1183 \\ 0.216 \end{bmatrix}$$

$$= \begin{bmatrix} 141 \times 0.1183 + (-141) \times (-0.216) \\ 188.44 \times 0.1183 + (188.44) \times (-0.216) \\ -173.2 \times 0.1183 + (-100)(-0.216) \\ -125 \times 0.1183 + 216.25 \times (0.216) \end{bmatrix}$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 16.68 + 30.46 \\ 22.29 - 40.70 \\ -20.48 + 21.6 \\ -14.79 + 66.71 \end{bmatrix}$$

#02/09

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 47.136t \\ -18.413t \\ 1.11t \\ -61.498t \end{bmatrix}$$



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Q#02

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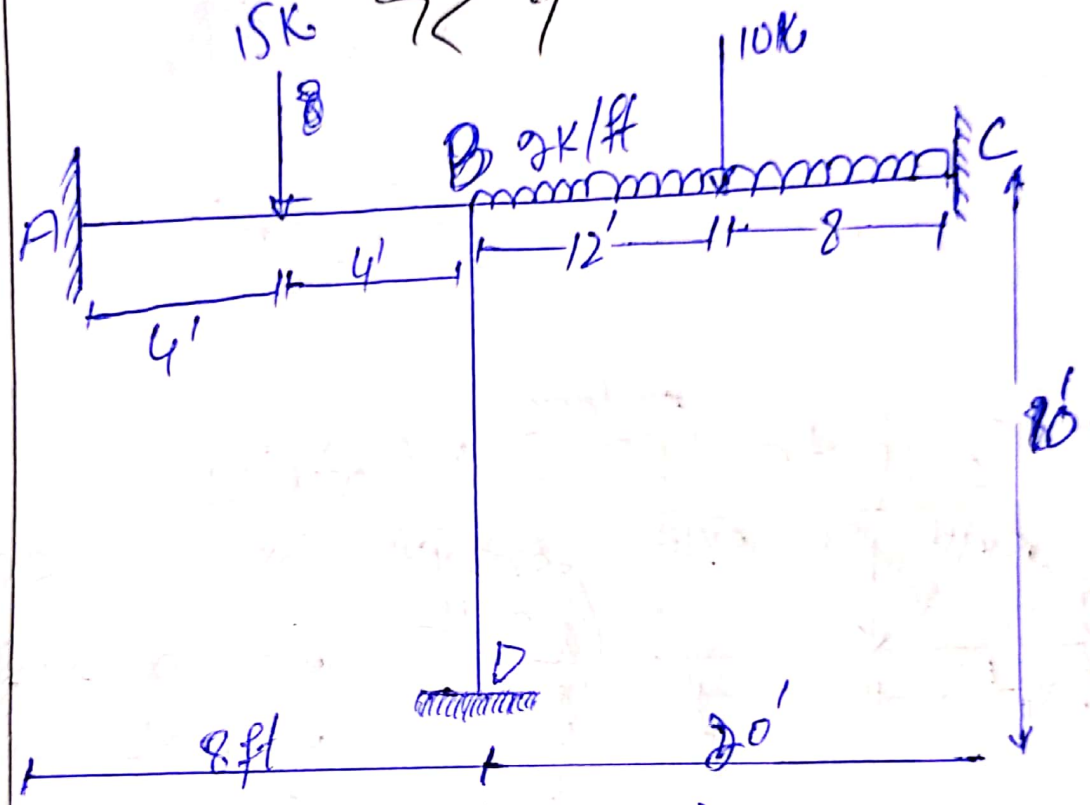
(Fig-2)



(Fig-2)

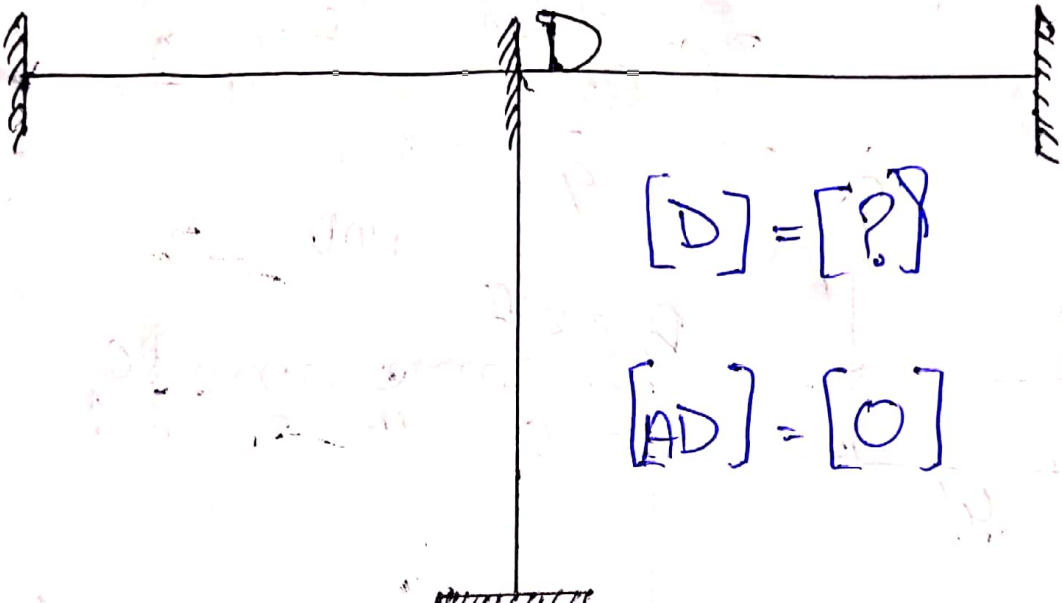
Solution

01 step ⇒ Determine Kinematic Indeterminacy

$K.I = 1^{0}$

02 step ⇒ Determine Unknown Joint Displacement.

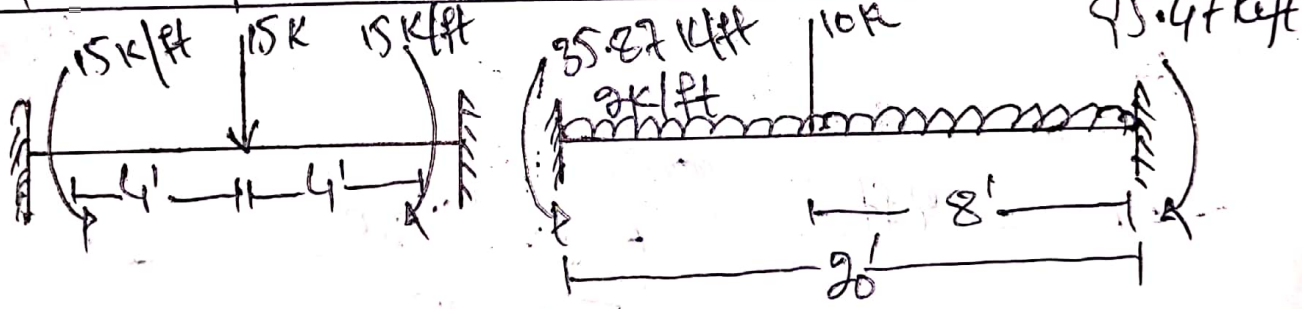
3/02

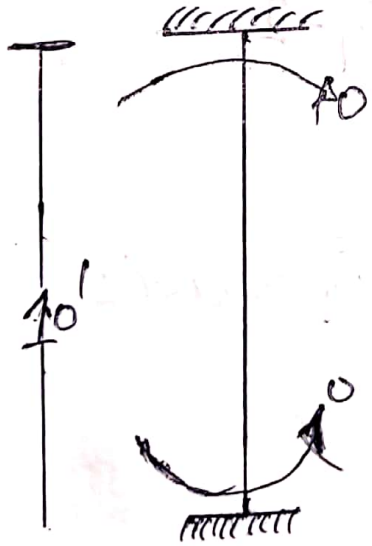


$[D] = [?]$

$[AD] = [0]$

Q3 ⇒ Compute [ADL] Matrix.





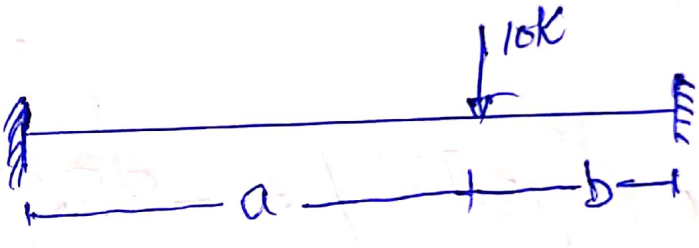
⇒ Point load at Center ⇒

$\Rightarrow PL/8 \Rightarrow \frac{(15)(8)}{8} \Rightarrow$ **15 K/ft**

Uniformly Distributed load:

$$\frac{WL^2}{12} = \frac{2(20)^2}{12} = 66.67 \text{ K-ft}$$

Point Load (Not at Mid):



Suppose:

For Left End:

$$\frac{Pab^2}{L^2} = \frac{(10)(12)(8)^2}{(20)^2} = 19.2 \text{ K-ft}$$

For Right End:

$$\frac{Pa^2b}{L^2} = \frac{(10)(12)^2(8)}{(20)^2} = 28.8 \text{ K-ft}$$

L#03/04

⇒ So Total Moment at left end:-

⇒ 19.2 + 66.67 ⇒ 85.87 K.ft

⇒ Similarly at Right End:-

⇒ 28.8 + 66.7 ⇒ 85.47 K.ft

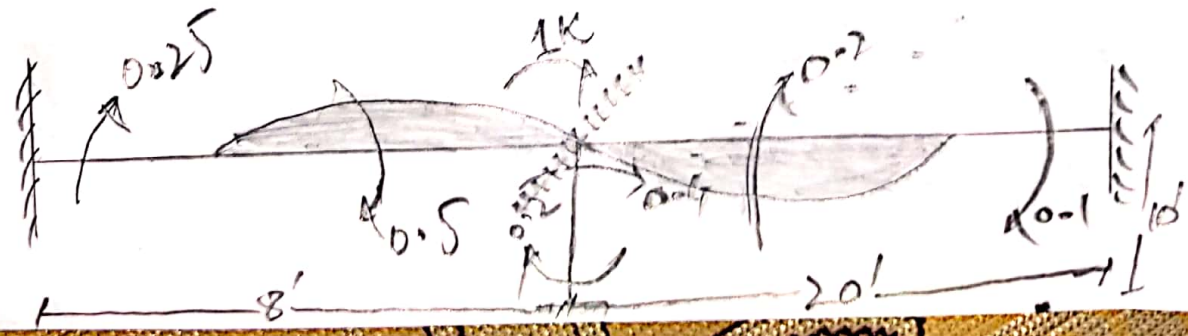
⇒ So [ADL] ⇒ −85.87 + 15

⇒ −70.87 K.ft

04 ⇒ Determine [S] Matrix:-

[S] = [S11]

Now (D) = (1K)



$\rightarrow \frac{4EI}{8} = 0.5 \quad \frac{2EI}{8} = 0.25$

$\rightarrow \frac{4EI}{20} = 0.2 \quad \frac{2EI}{20} = 0.1$

$\rightarrow \frac{4EI}{10} = 0.4 \quad \frac{2EI}{10} = 0.2$

$$[S] = (0.5 + 0.4 + 0.2)EI$$

$$= 1.1\,EI$$

$$[S] = 1.1\,EI$$

STEP #05 COMPUTE [D] MATRIX

$$[D] = [S]^{-1} \times [AD] - [ADL]$$

#03/06

$$[D] = \frac{1}{1.1} \times [0] - [-70.87]$$

$$\Rightarrow \frac{70.87}{1.1}$$

$$[D] = [64.42] \frac{1}{ET}$$

Completed

Q#03

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