ID	7655
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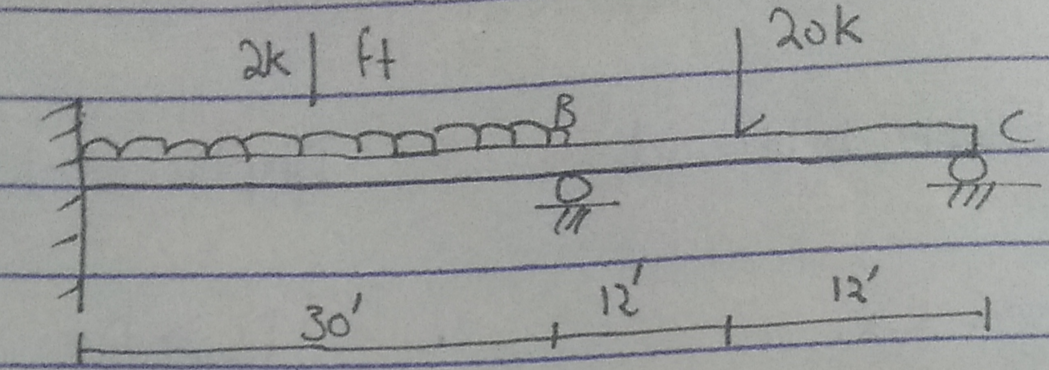
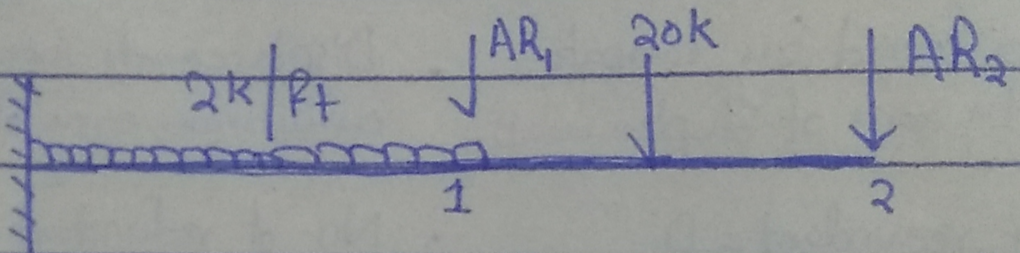
Subject	Structure advance
Submitted to	Engr Adeed
Date	21/8/20
Semester	12th (summer

Q1



Sol Structural Indeterminancy = 2°

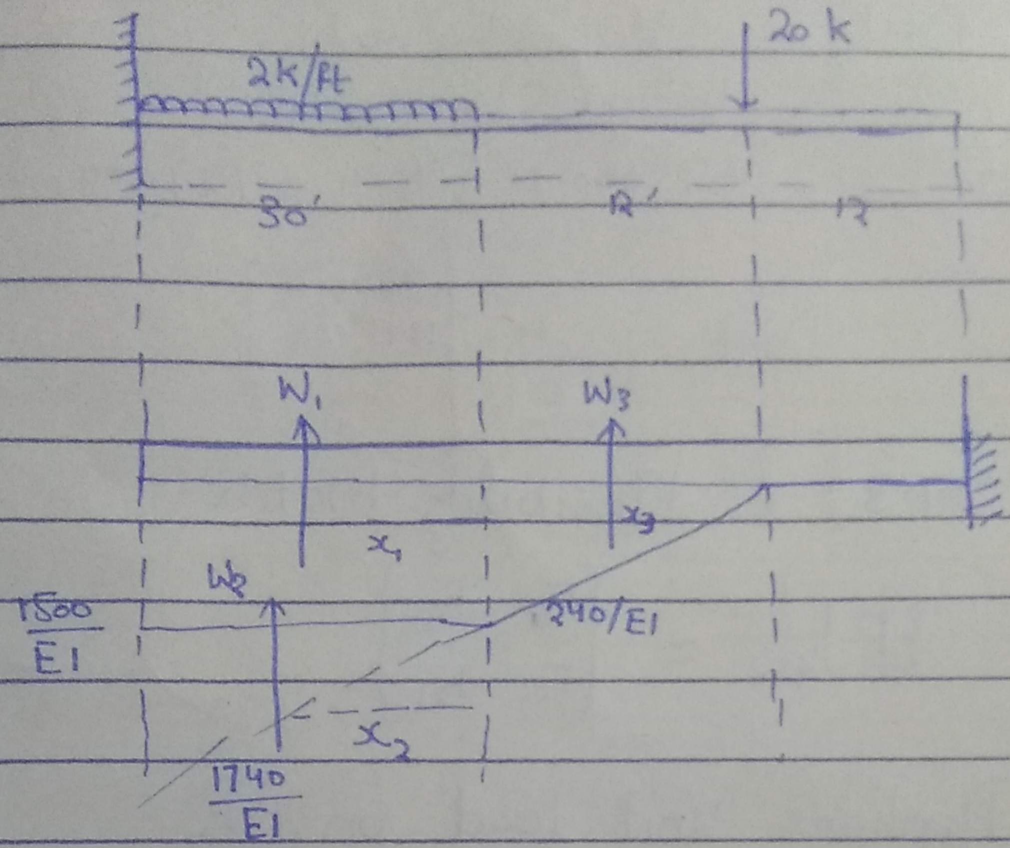
Step 1 # Select Redundant Actions



$$\begin{bmatrix} DR_{S_1} \\ DR_{S_2} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \quad \begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$$

$$[DR_S] = [DRL] + [F] \times [AR]$$

Step #2 Compute the value of [DRL]



$20 \times 12 = 240$

$20 \times (12 + 30) + (2 \times 30) \times 15$
$= 1740$

$W_1 = 1500 \times 30 = 45000$

$W_2 = \frac{1}{3} \times 30 \times 240 = 2400$

$W_3 = \frac{1}{2} \times 12 \times 240 = 1440$

$x_1 = b/2 = 30/2 = 15'$

$x_2 = \frac{3 \times L}{n+2} = \frac{3}{2+2} \times 30 = 22.5'$, $x_3 = \frac{2}{3} \times L = 8'$

Now finding DRL :-

$DRL_2 = W_1 \times (x_1 + 24) + W_2 \times (x_2 + 24) + W_3 (x_3 + 12)$

$= 45000 (15 + 24) + 2400 (22.5 + 24.5) + 1440 (8 + 12)$

$DRL_2 = 175000 + 111600 + 28800 = 1895400/EI$

Day: M T W T F S

$DRL_1 = w_1(x_1) + w_2(x_2)$

$= 45000(15) + 2400(22.5)$

$= 675000 + 54000 = 729000$

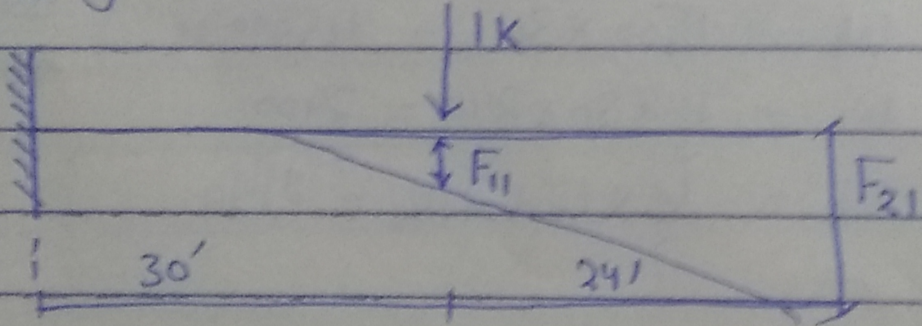
So,

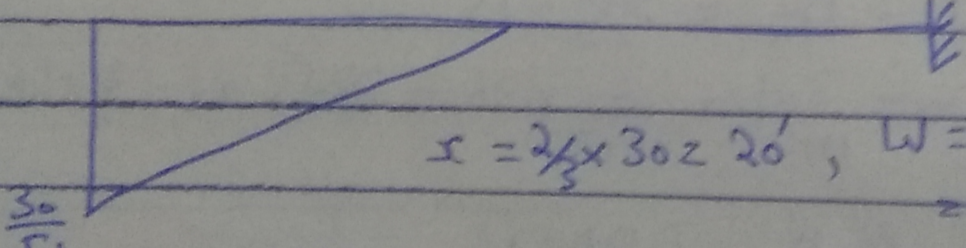
$$DRL = \frac{1}{EI}\begin{bmatrix} 729000 \\ 1895400 \end{bmatrix}$$

Step 3 ; Flexibility Matrix

$$[F]_{2\times2} = \begin{bmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{bmatrix}$$

Applying unit load on AR_1





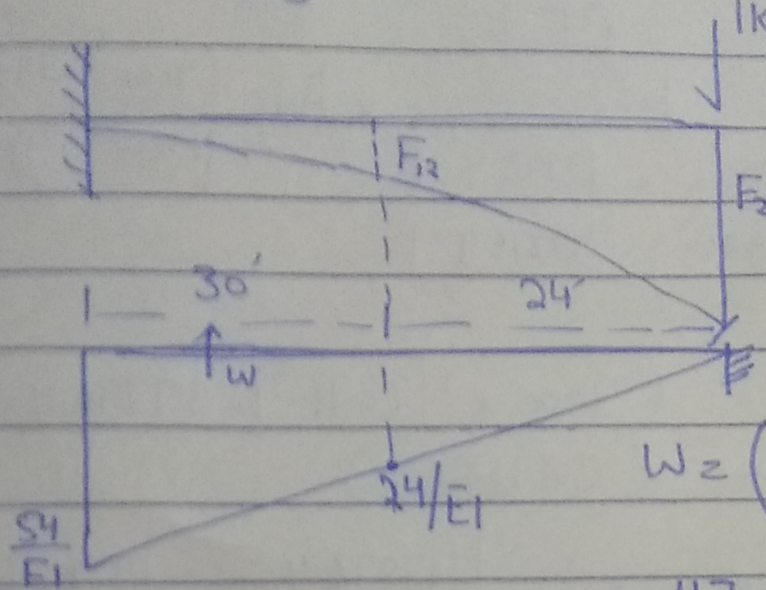
$x = \frac{2}{3} \times 30 = 20'$, $W = \frac{1}{2}\left(\frac{30}{EI} \times 30\right)$

$= 450/EI$

So, $F_{11} = \frac{450}{EI}(20) = 9000/EI$

$F_{21} = \frac{450}{EI}(20+24) = 19800/EI$

Now Applying unit load on AR_2;



$$W = \left(\frac{54+24}{2EI}\right)\times 30$$

$$= 1170/EI$$

Now

$$x = \frac{L}{3}\left[\frac{b+2a}{a+b}\right]$$

$$= \frac{30}{3}\left[\frac{24+2(54)}{54+24}\right] = 16.92$$

$$F_{12} = \frac{1170}{EI} \times 16.92 = \frac{19796.4}{EI}$$

Hence

$$F_{2\times2} = \begin{vmatrix} 9000 & 19796.4 \\ 19800 & 47876.4 \end{vmatrix} \frac{1}{EI}$$

Step # 4; Compute the values AR

$$[DR_s] = [DRL] + [F] \times [AR]$$

$$[AR] = [DR_s - DRL] \times [F]^{-1}$$

$$[F]^{-1} = \frac{1}{[F]} \times Adj\ F$$

$$= \frac{1}{\begin{vmatrix} 9000 & 19796.4 \\ 19800 & 47876.4 \end{vmatrix}} \times Adj \begin{bmatrix} 9000 & 19796.4 \\ 19800 & 47876.4 \end{bmatrix}$$

$$|F| = (9000 \times 47876.4 - 19796.4 \times 19800)$$
$$= (38918880)$$

$$\Rightarrow \quad Adj\ A = \begin{bmatrix} 47876.4 & -19796.4 \\ -19800 & 9000 \end{bmatrix}$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} 0 & -729000 \\ 0 & -1895400 \end{bmatrix} \frac{1}{EI} \times \frac{1}{38918880}$$

$$= \begin{bmatrix} -729000 \\ -1895400 \end{bmatrix} \frac{1}{EI} \times \frac{\begin{bmatrix} 47876.4 & -19796.4 \\ -19800 & 9000 \end{bmatrix}}{38918880}$$

$$\begin{bmatrix} AR_1 \\ AR_2 \end{bmatrix} = \begin{bmatrix} 66.193 \\ 67.505 \end{bmatrix}$$

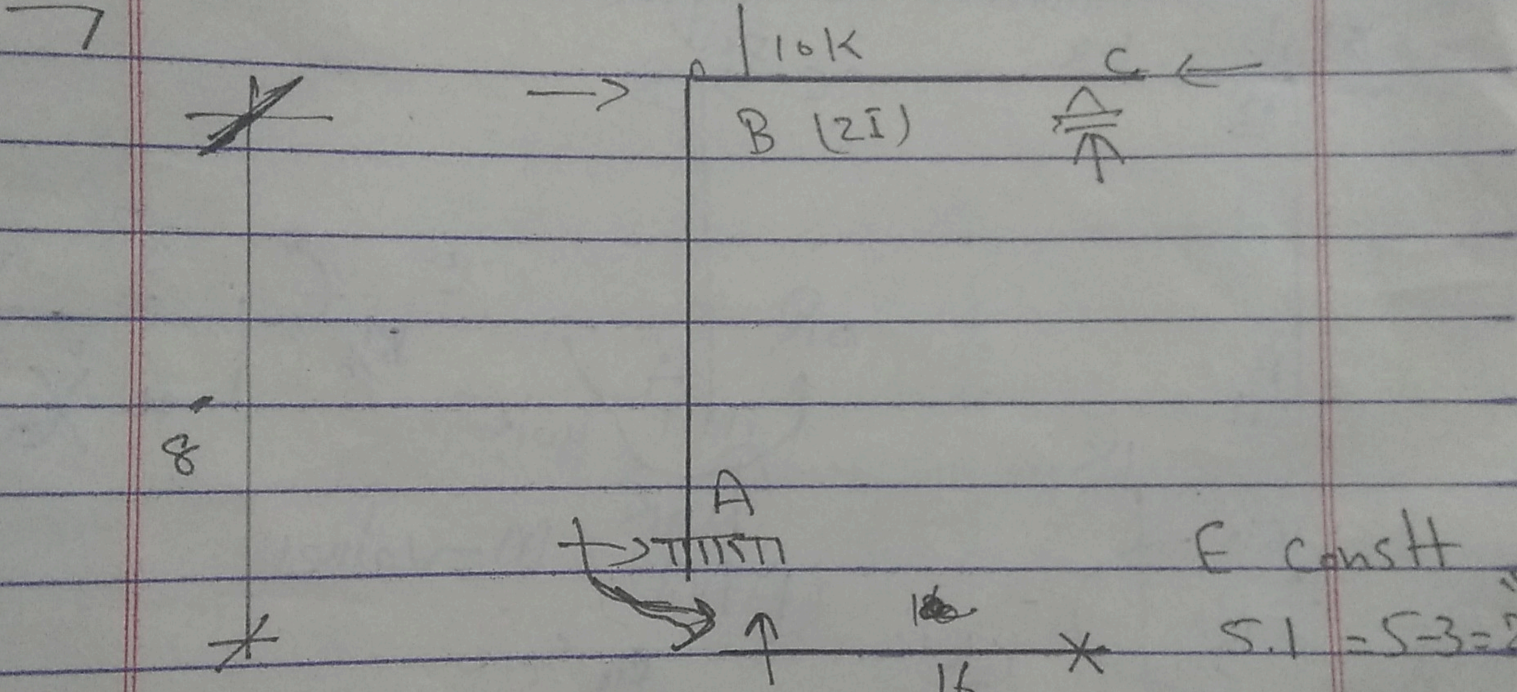
Q2 D/F b/w force method and displacement method and suggest which method is more suitable for structure analysis in matrix approch?

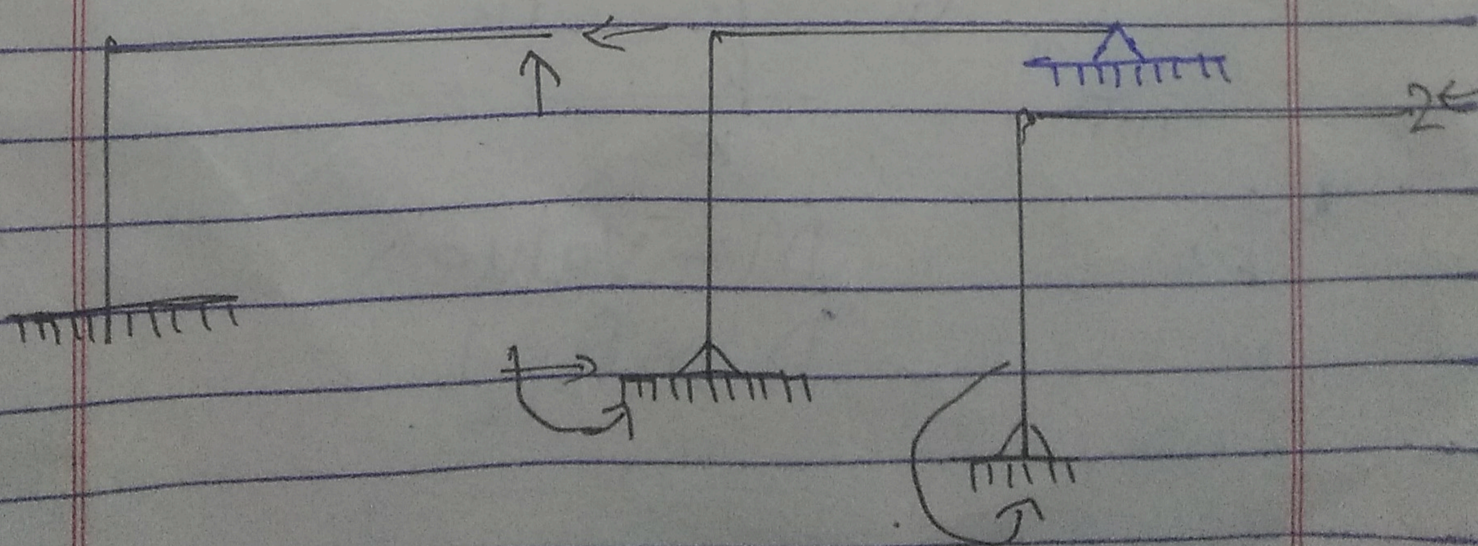
Ans)

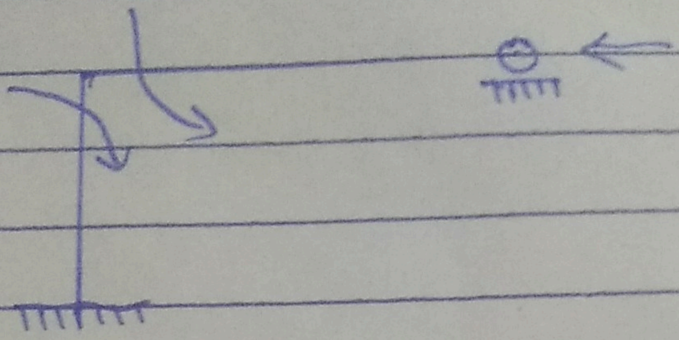
Force Method	Displacement Method
• $D_s < D_K$	• $D_s > D_K$
• Forces are redundent or unknowns.	• Displacement are unknown.
• Starts with equillibrium of forces.	• Starts with compatible deformation.
• Forces found by compati-billity eqns of displacements.	• Displacements found by equillibrium eqns of forces
• No of redundant = D_s	• No of redundant = DK
• not suitable for computer.	• not suitable for trusses.

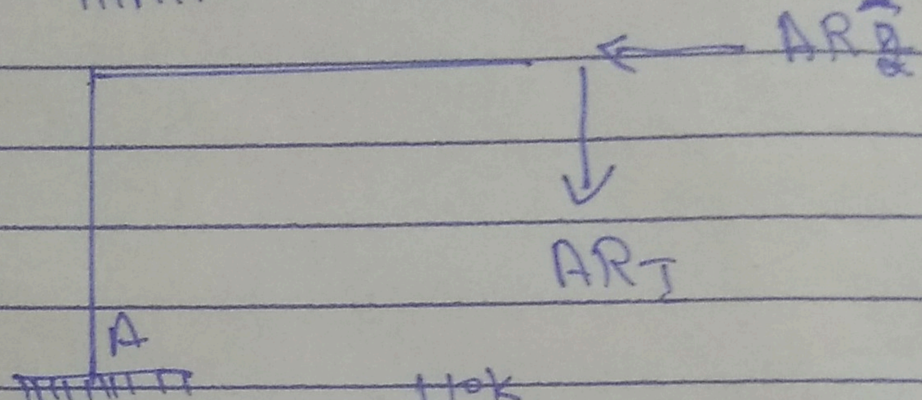
→ Stiffness method also called displacement method is more suitable for structure analysis matrixs approach, as it is a primary method used in matrix analysis. The main advantage of this method over flexibility method is that is conductive to computer programming. Once the analytical model of the structure has been

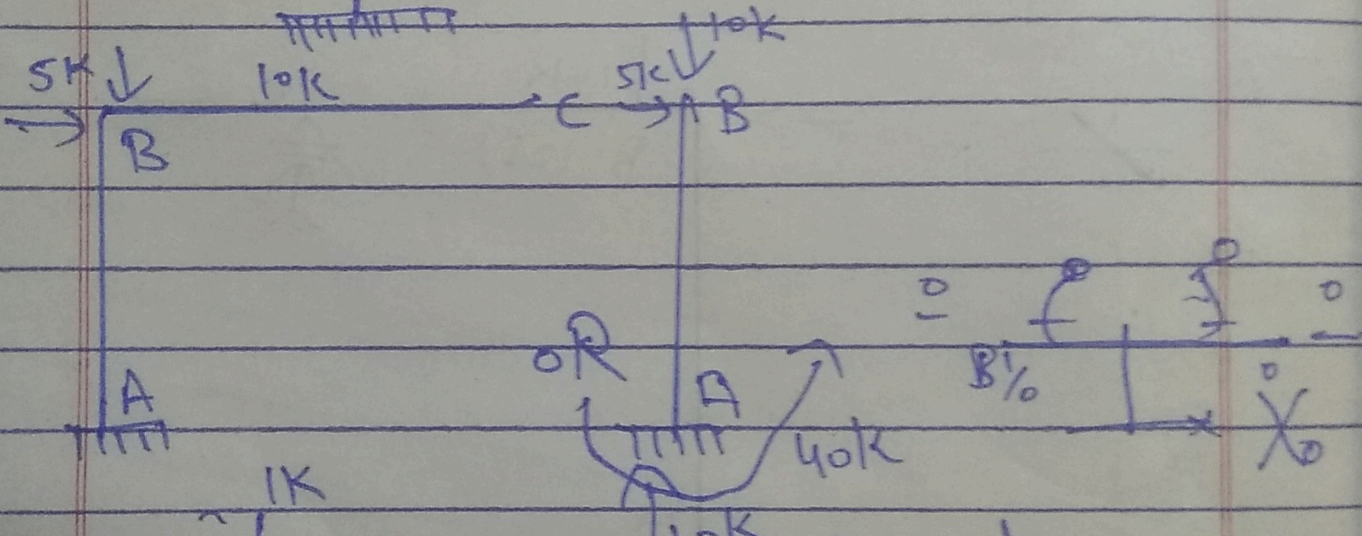
Q3) Solve the following Problem through flexibility method;

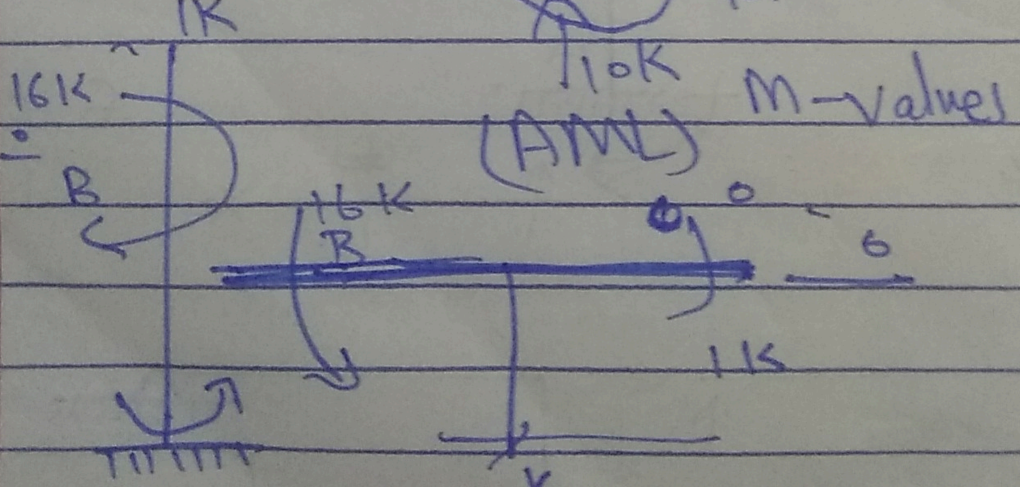












M-values
AMR-1

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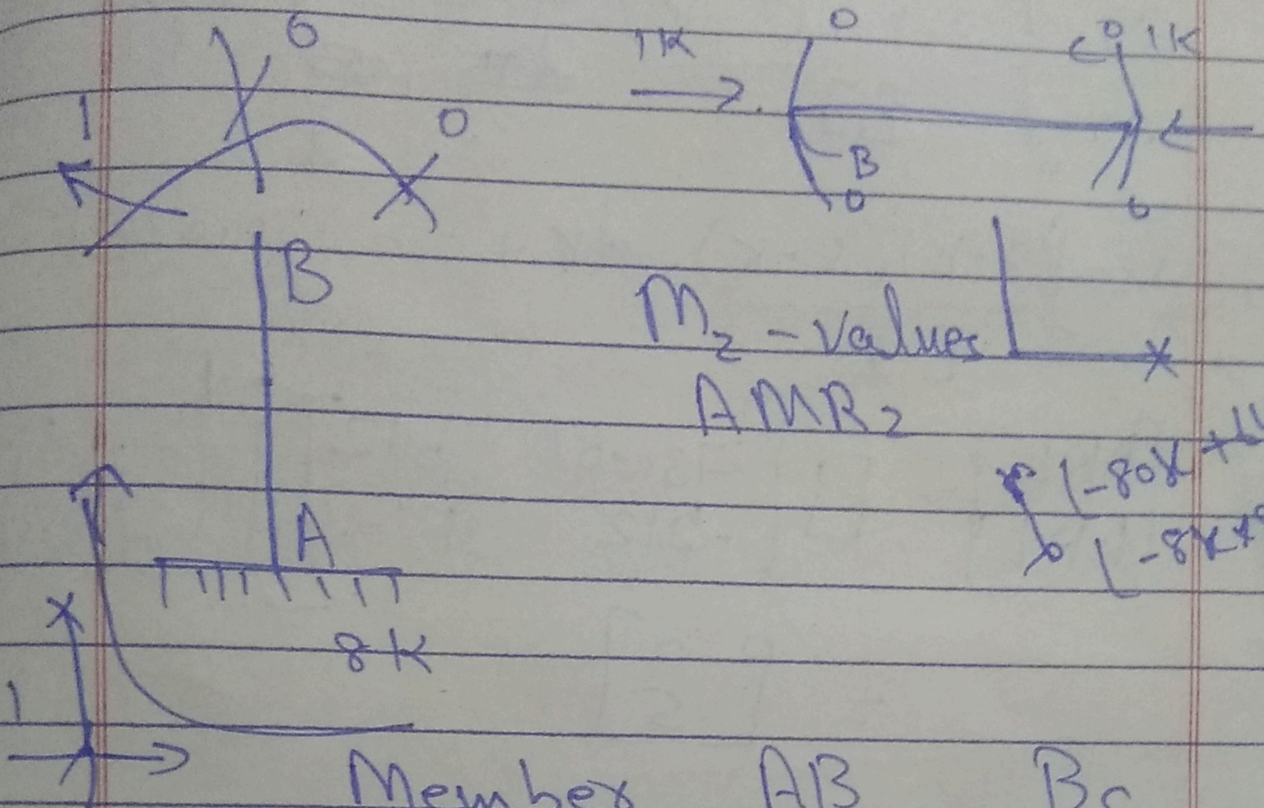


M_2 - values

AMR$_2$

$(-80x+640)$

$(-8x+8640)$

Member	AB	BC
origin	A	C
limits	$0 \to 8$	$0 \to 16$
I	I	2I
m	-16	$-x$
m2	$8-x$	0

$$DR_4 = \int_0^8 \frac{(5x-40)}{EI}(-16)\,dx + \int_0^6 \frac{(0)(-x)}{2EI}\,dx$$

$$= 2560\,EI$$

$$BRL \int_B^0 \frac{(5x+40)(8-x)}{EI} = -853.33/EI$$

$$f_{11} \int_0^0 \frac{(-16)(8-x)}{EI}\,dx + \int_0^{16} \frac{(-x)\cdot(-x)}{2EI}$$

Checked By:............ Good

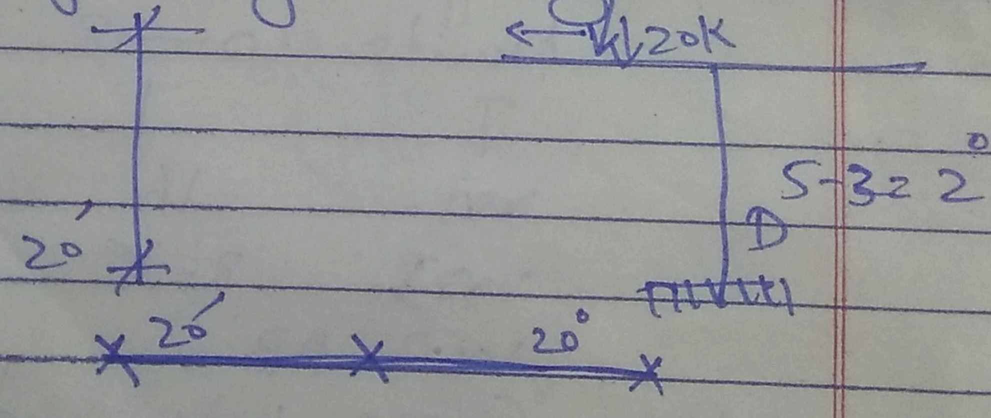
$$f_{21} \int_0^{?} \frac{(8-x)(8-x)}{EI} + 0 = \frac{-512}{EI}$$

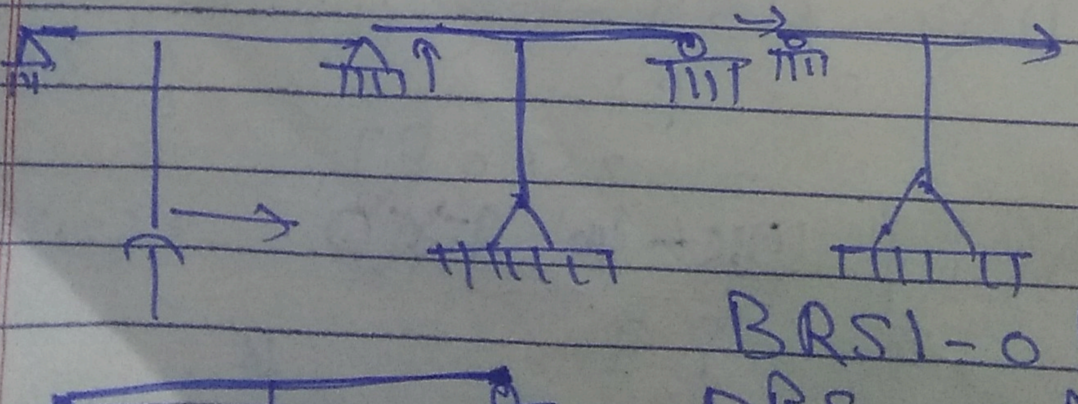
$$f_{22} \int \frac{(8-x)(8-x)}{EI} dx + 0 = 170.67/EI$$

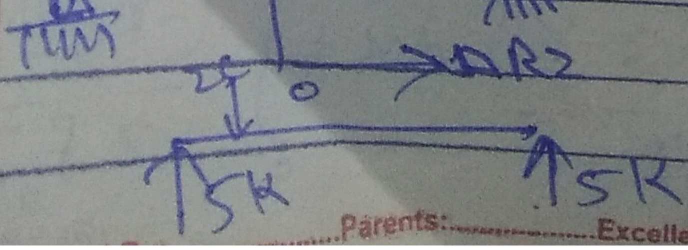
$$\begin{bmatrix} ARL \\ ARL' \end{bmatrix} = \square \left(\begin{bmatrix} 2730.67 & -512 \\ -512 & 170.67 \end{bmatrix} \right)^{-1} \begin{bmatrix} 0-2560 \\ 0-(-853.33) \end{bmatrix} \frac{x}{EI}$$

$$= \begin{bmatrix} 0 \\ 5 \end{bmatrix}$$

Analyse by fexibility Methods

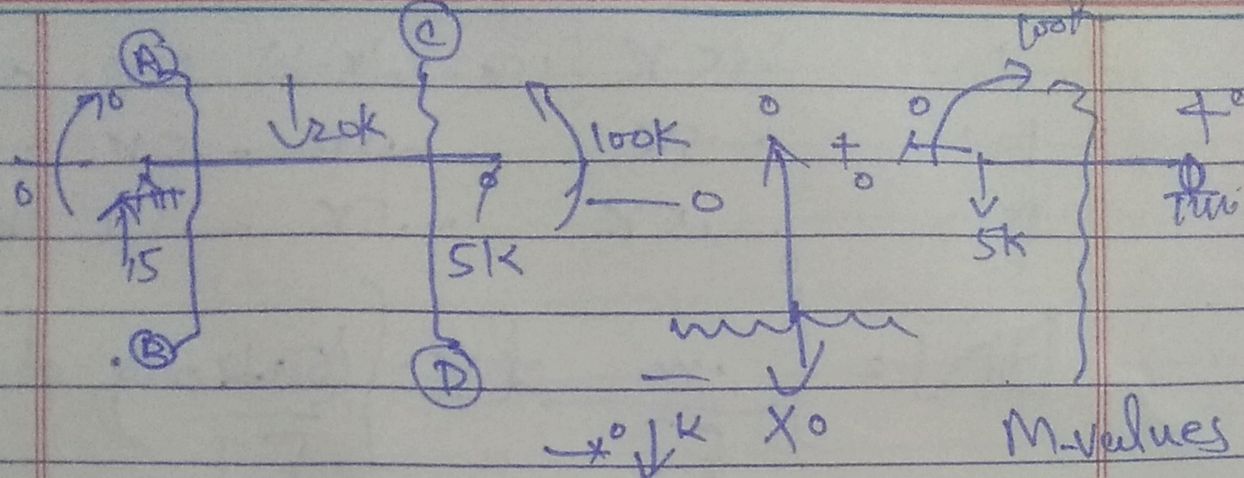


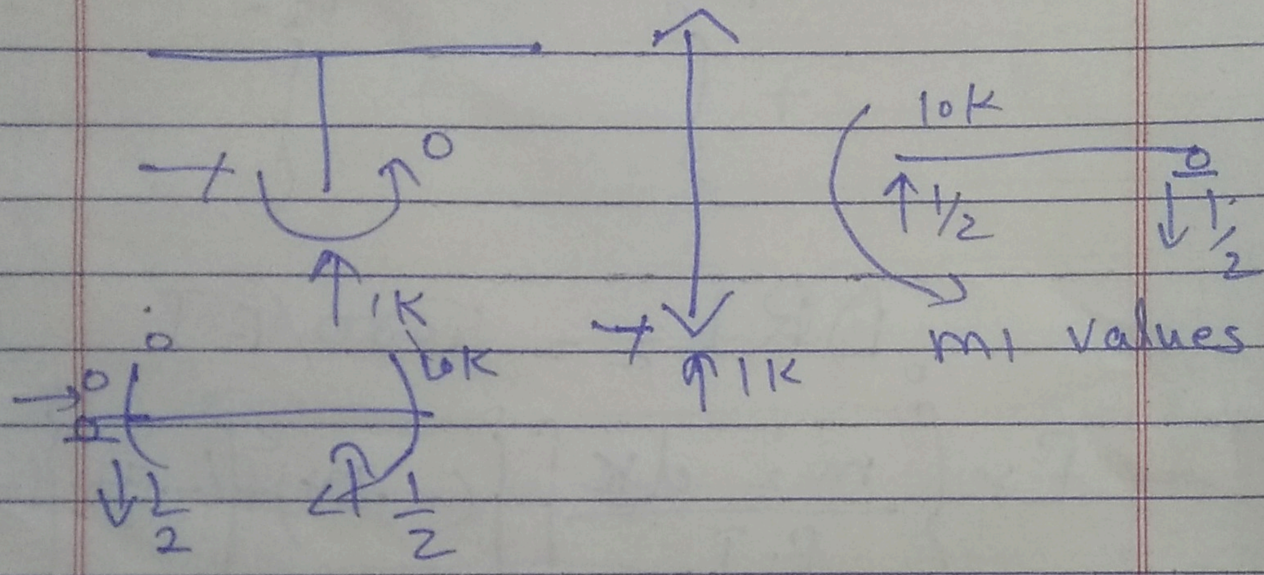


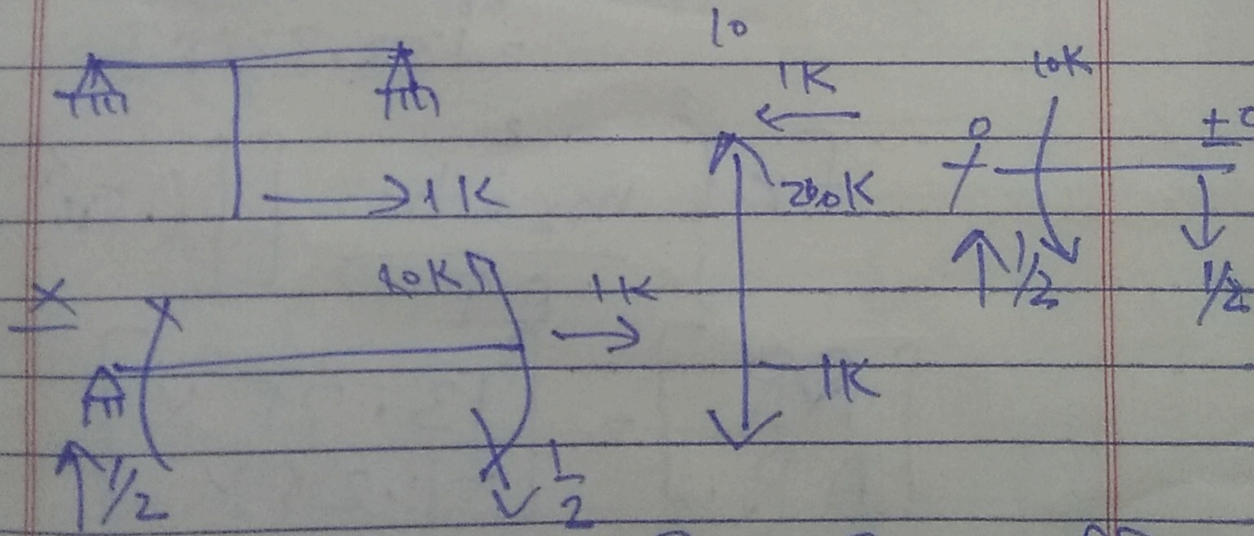


BRS1 = 0 AR1 = ?

DRS2 = 0 ARS2 = ?







members	AB	Bc		BD
origin	A	A	C	O
Limit	→10	10-20	0→20	0→20
I	I	I	I	I

m	15x	15x − 20(x − 10)	5x	0
m1	−.5x	−.5x	−.5x	0
m2	−.5x	−.5x	−.5x	1x

$$DRL = \int_0 \frac{\cdot m}{EI} dx = \int \frac{(15x + 200x)}{EI} dx$$

$$+ \int_0 \quad + \int_0$$

$$DRL = 5000/EI$$

$$Fx \int_0 \frac{m^2 \, dx}{EI} \left[\int_0 (-.5x)^2 + \int_0 (-.5)^2 + \int_0 (-.5x)^2 \right.$$

$$= 133.33/EI$$

$$Fx \int_0 \frac{m_2^2 \, dx}{EI} = \left[\int (.5x)^2 + \right.$$

$$\begin{bmatrix} AR \\ AR \end{bmatrix} = \begin{bmatrix} 13.75\,K \\ -1.25\,K \end{bmatrix}$$