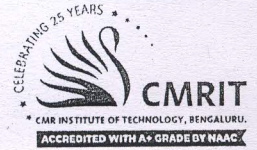


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52



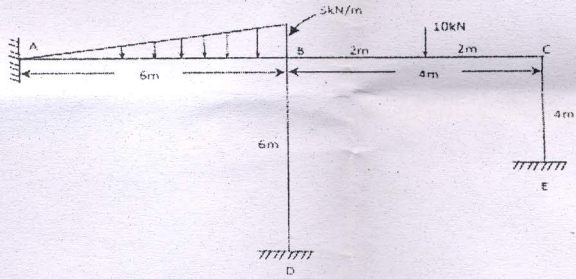
Internal Assessment Test 2 – October. 2018

Sub:	Analysis of indeterminate Structures				Sub Code:	15CV52	Branch:	CV
Date:	15.10.2018	Duration:	90 min's	Max Marks:	50	Sem / Sec:	V <sup>th</sup> A & B	

**All questions are compulsory**

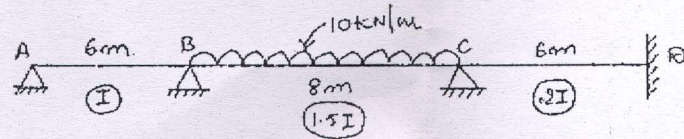
1 (a) Analyse the frame shown in Fig by moment distribution method. Draw BMD

MARKS	CO	RBT
[25]	CO2	L3



2 (a) Analyse the continuous beam shown in Fig by Kani's method. Draw SFD and BMD

[25]	CO3	L3
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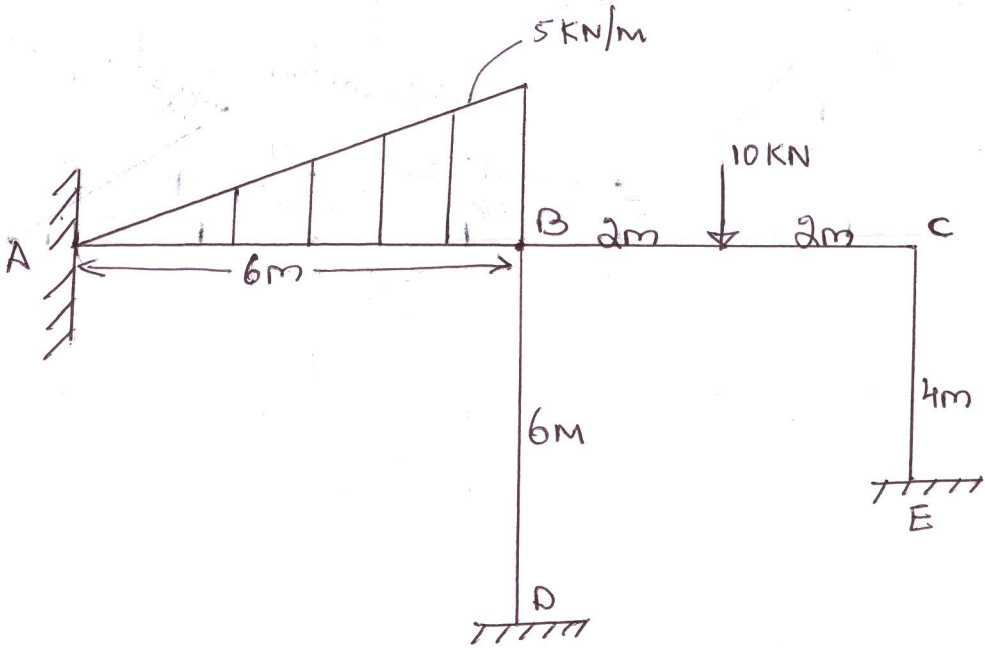


Selected  
M. D. L.

Selected

# Internal assessment - II

1.

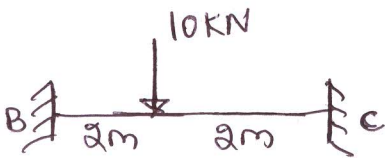


Step 1 - Fixed End moment



$$M_{FAB} = -\frac{wl^2}{30} = -\frac{5 \times 6^2}{30} = -6 \text{ kNm}$$

$$M_{FBA} = \frac{wl^2}{20} = \frac{5 \times 6^2}{20} = +9 \text{ kNm}$$



$$M_{FBC} = -\frac{wl}{8} = -\frac{10 \times 4}{8} = -5 \text{ kNm}$$

$$M_{FCB} = \frac{wl}{8} = \frac{10 \times 4}{8} = 5 \text{ kNm}$$



$$M_{FBD} = M_{FDB} = 0 \text{ kNm}$$



$$M_{FCE} = M_{FEC} = 0 \text{ kNm}$$

## Step 2: Distribution factors

joint	members	K	$\sum K$	D.F = $K/\sum K$
B	BA	$I/2 = I/6 = 0.167I$	0.584I	$\frac{0.167I}{0.584I} = 0.29$
	BD	$I/2 = I/6 = 0.167I$		$\frac{0.167I}{0.584I} = 0.29$
	BC	$I/2 = I/4 = 0.25I$		$\frac{0.25I}{0.584I} = 0.42$
C	CB	$I/2 = I/4 = 0.25I$	0.5I	$\frac{0.25I}{0.5I} = 0.5$
	CE	$I/2 = I/4 = 0.25I$		$\frac{0.25I}{0.5I} = 0.5$

## Step 3: Moment distribution table

joint								
Members	AB	BA	BD	DB	BC	CB	CE	EC
D.F		0.29	0.29		0.42	0.5	0.5	
FEM	-6	9	0	0	-5	5	0	0
Balance		$\swarrow$ 50% -1.16	$\swarrow$ 50% -1.16		$\swarrow$ 50% -1.68	$\swarrow$ 50% -2.5	$\swarrow$ 50% -2.5	
Carry over	-0.58			-0.58	-1.25	-0.84		-1.25
Balance		$\swarrow$ 50% 0.362	$\swarrow$ 50% 0.362		$\swarrow$ 50% 0.525	$\swarrow$ 50% 0.42	$\swarrow$ 50% 0.42	
Carry over	0.181			0.181	0.21	0.263		0.21
Balance		$\swarrow$ 50% -0.06	$\swarrow$ 50% -0.06		$\swarrow$ 50% -0.088	$\swarrow$ 50% -0.131	$\swarrow$ 50% -0.131	
Carry over	-0.03			-0.03	-0.065	-0.044		-0.065
Balance		0.018	0.018		0.027	0.022	0.022	

$B = BA + BD + BC = 9 + 0 + (-5) = 4 \Rightarrow -4$

$C = CB + CE = 5 + 0 = -5$

$BA = 0.29 \times -4 = -1.16$   
 $BD = 0.29 \times -4 = -1.16$   
 $BC = 0.42 \times -4 = -1.68$

$CB = 0.5 \times -5 = -2.5$   
 $CE = 0.5 \times -5 = -2.5$



Step 4: End moments

$$M_{AB} = -6 - 0.58 + 0.181 - 0.03 = -6.429 \text{ kNm}$$

$$M_{BA} = 9 - 1.16 + 0.362 - 0.06 + 0.018 = 8.16 \text{ kNm}$$

$$M_{BD} = 0 - 1.16 + 0.362 - 0.06 + 0.018 = -0.84 \text{ kNm}$$

$$M_{DB} = 0 - 0.58 + 0.181 - 0.03 = -0.429 \text{ kNm}$$

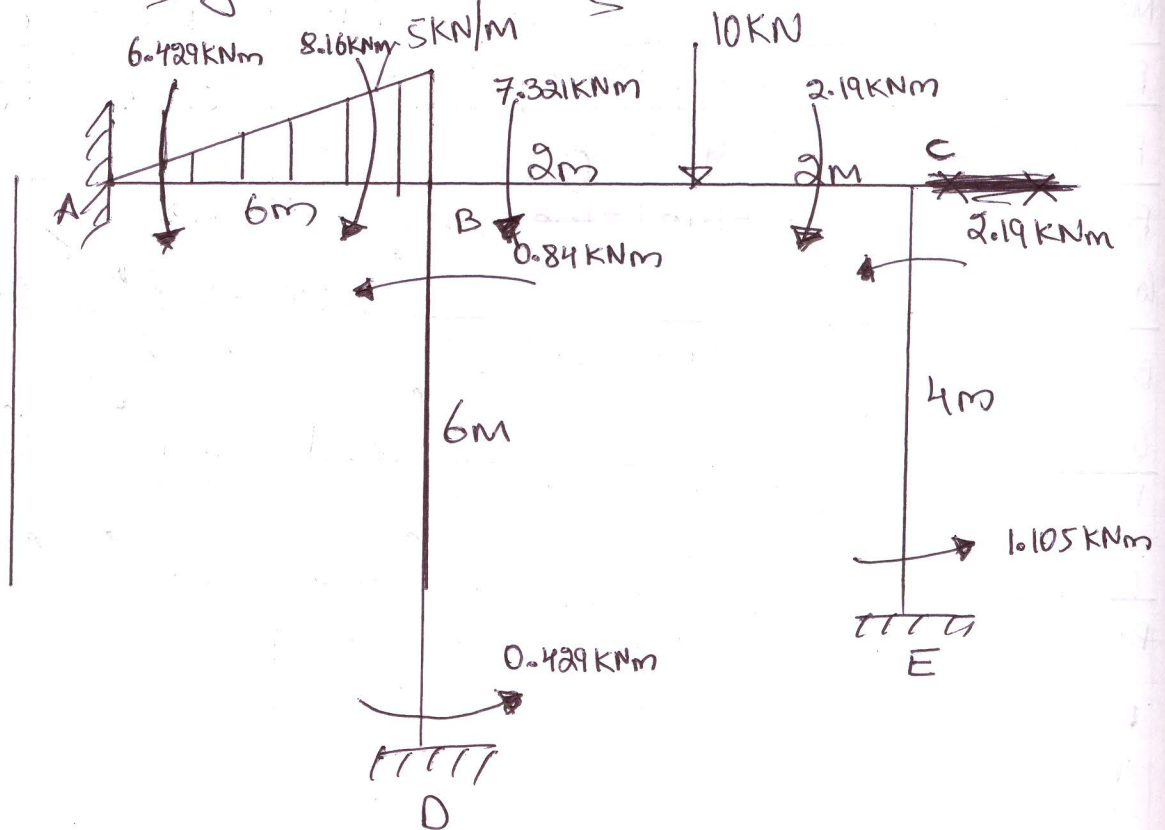
$$M_{BC} = -5 - 1.68 - 1.25 + 0.525 + 0.21 - 0.088 + 0.065 + 0.027 = -7.321 \text{ kNm}$$

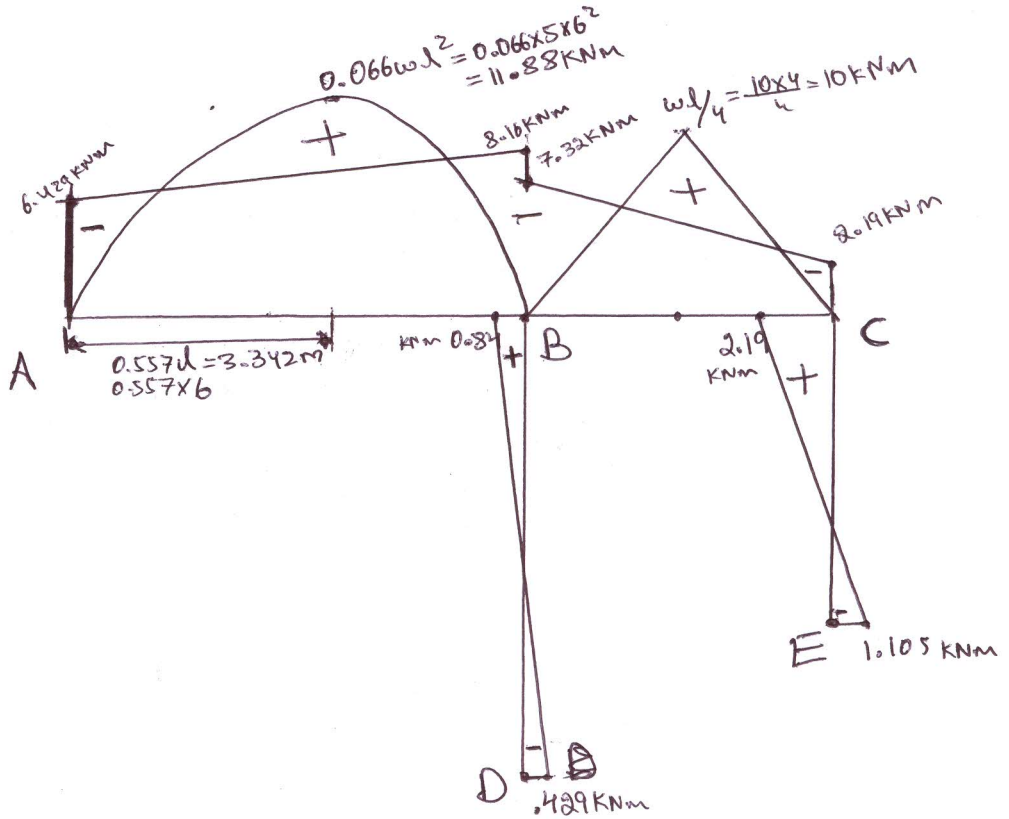
$$M_{CB} = 5 - 2.5 - 0.84 + 0.42 + 0.263 - 0.131 - 0.44 + 0.22 = 2.19 \text{ kNm}$$

$$M_{CE} = -2.5 + 0.42 - 0.131 + 0.022 = -2.19 \text{ kNm}$$

$$M_{EC} = -1.25 + 0.21 - 0.065 = -1.105 \text{ kNm}$$

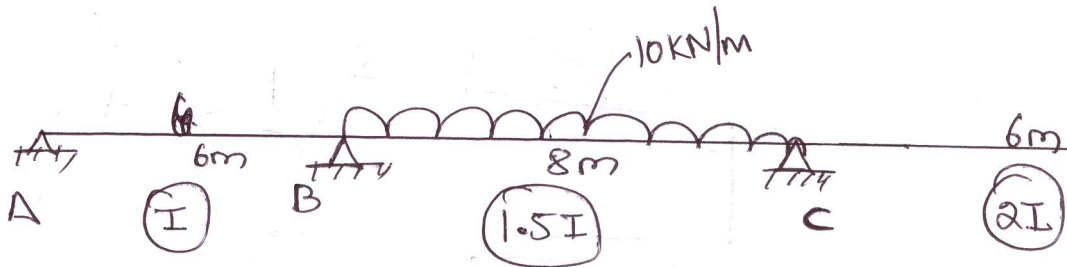
Steps: Bending Moment Calculation





All units of moment are in kNm

2.



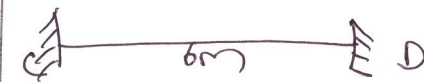
Step 1 :- Fixed End moment



$$M_{FAB} = M_{FBA} = 0 \text{ KNm}$$

$$M_{FBC} = \frac{-wl^2}{12} = \frac{-10 \times 8^2}{12} = -53.33 \text{ KNm}$$

$$M_{FCB} = \frac{wl^2}{12} = \frac{10 \times 8^2}{12} = 53.33 \text{ KNm}$$

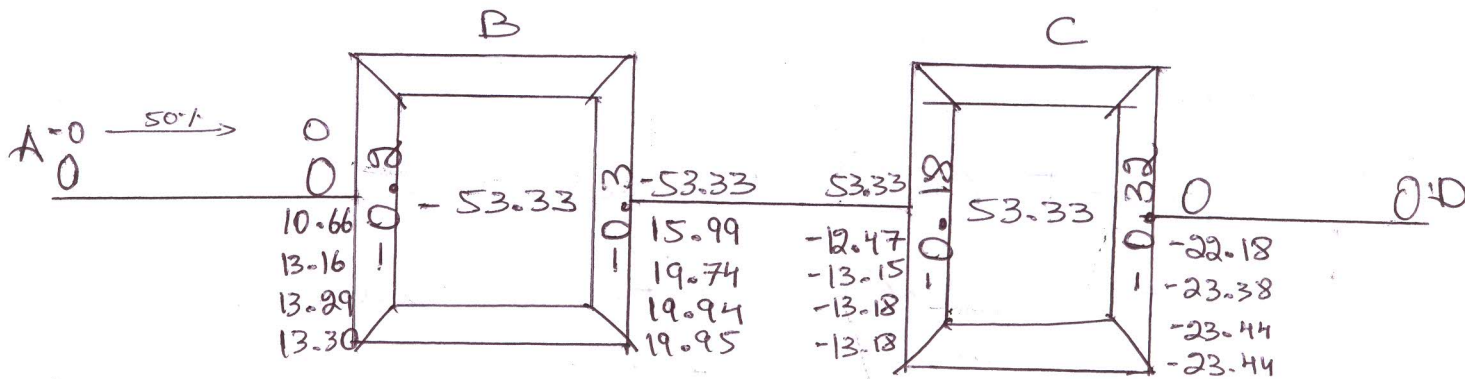


$$M_{FCD} = M_{FDC} = 0 \text{ KNm}$$

Step 2 :- Rotational factors

joint	members	K	$\Sigma K$	$U = -\frac{1}{2} \frac{K}{\Sigma}$
B	BA	$\frac{3 \times I}{4 \times l} = \frac{3 \times I}{4 \times 6} = 0.125 I$	0.32 I	-0.2
	BC	$\frac{I}{l} = \frac{1.5 I}{8} = 0.187 I$		-0.3
C	CB	$\frac{I}{l} = \frac{1.5 I}{8} = 0.187 I$	0.52 I	-0.18
	CD	$\frac{I}{l} = \frac{2 I}{6} = 0.333 I$		-0.32

Step 3: Rotational moment  $m' = U(M_F + FERM)$



Trial 1

$$M_{BA} = -0.2(-53.33 + 0) = 10.66$$

$$M_{BC} = -0.3(-53.33 + 0) = 15.99$$

$$M_{CB} = -0.18(53.33 + 15.99) = -12.47$$

$$M_{CD} = -0.32(53.33 + 15.99) = -22.18$$

Trial 2

$$M_{BA} = -0.2(-53.33 - 12.47) = 13.16$$

$$M_{BC} = -0.3(53.33 - 12.47) = 19.74$$

$$M_{CB} = -0.18(53.33 + 19.74) = -13.15$$

$$M_{CD} = -0.32(53.33 + 19.74) = -23.38$$

Trial 3

$$M_{BA} = -0.2(-53.33 - 13.15) = 13.29$$

$$M_{BC} = -0.3(-53.33 - 13.15) = 19.94$$

$$M_{CB} = -0.18(53.33 + 19.94) = -13.18$$

$$M_{CD} = -0.32(53.33 + 19.94) = -23.44$$

Trial 4

$$M_{BA} = -0.2(-53.33 - 13.18) = 13.30$$

$$M_{BC} = -0.3(-53.33 - 13.18) = 19.95$$

$$M_{CB} = -0.18(53.33 + 19.95) = -13.19$$

$$M_{CD} = -0.32(53.33 + 19.95) = -23.44$$

Step 4 :- End moments -  $M = M_F + 2 \times NERM + \cancel{1} \times FERM$

$$M_{AB} = 0$$

$$M_{BA} = 0 + 2 \times 13.30 + 1 \times 0 = 26.60 \text{ KNm}$$

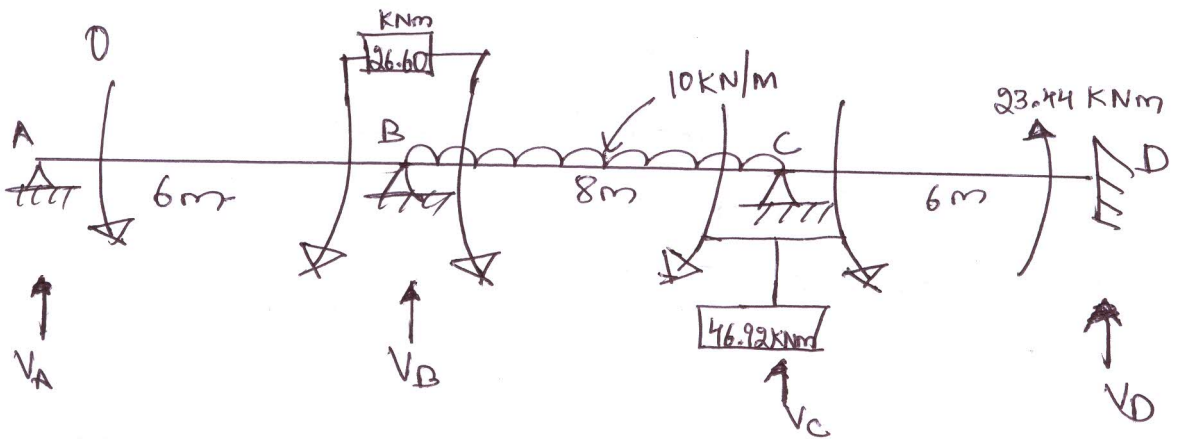
$$M_{BC} = -53.33 + 2 \times 19.95 + 1 \times (-13.18) = -26.61 \text{ KNm}$$

$$M_{CB} = 53.33 + 2 \times (-13.18) + 19.95 = 46.92 \text{ KNm}$$

$$M_{CD} = 0 + 2 \times (-23.44) + 1 \times 0 = -46.88 \text{ KNm}$$

$$M_{DC} = 0 + 2 \times 0 + 1 \times (-23.44) = -23.44 \text{ KNm}$$

steps :- Bending moment and shear force calculation



$$\Rightarrow \sum F_y = 0 \quad V_A + V_B + V_C + V_D = 10 \times 8 = 80 \text{ KNm}$$

$$V_A + V_B + V_C + V_D = 80 \text{ KN}$$



$$\Sigma M_B = 0 \text{ (LHS)}$$

$$-0 + 26.60 + V_A \times 6 = 0$$

$$\boxed{V_A = -4.43 \text{ KN}}$$

$$\Sigma M_C = 0 \text{ (RHS)}$$

$$-46.92 - 23.44 - V_D \times 6 = 0$$

$$\boxed{V_D = -11.72 \text{ KN}}$$

$$\Sigma M_B = 0 \text{ (RHS)}$$

$$-26.60 + 46.92 - 46.92 - 23.44 - V_C \times 8 - V_D \times 14 = 0$$

$$V_C = \frac{-26.60 + 46.92 - 46.92 - 23.44 - (-11.72) \times 14}{8}$$

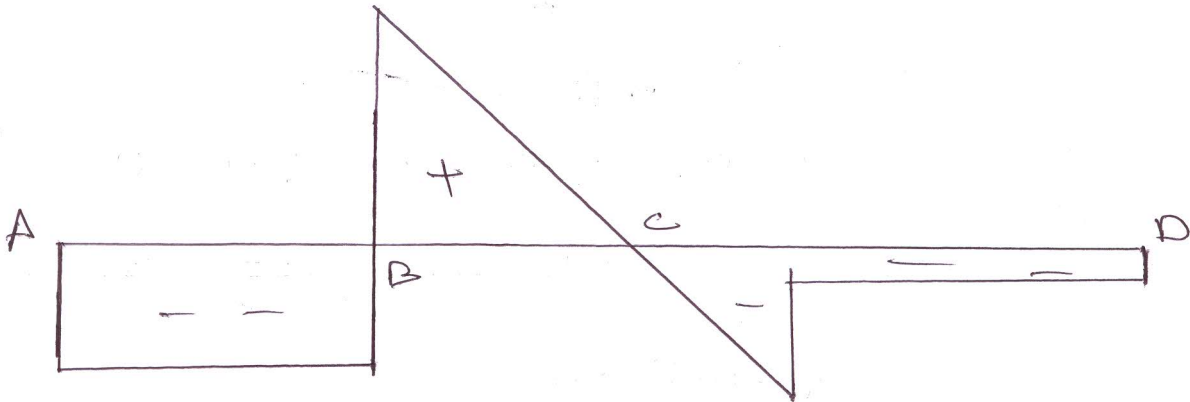
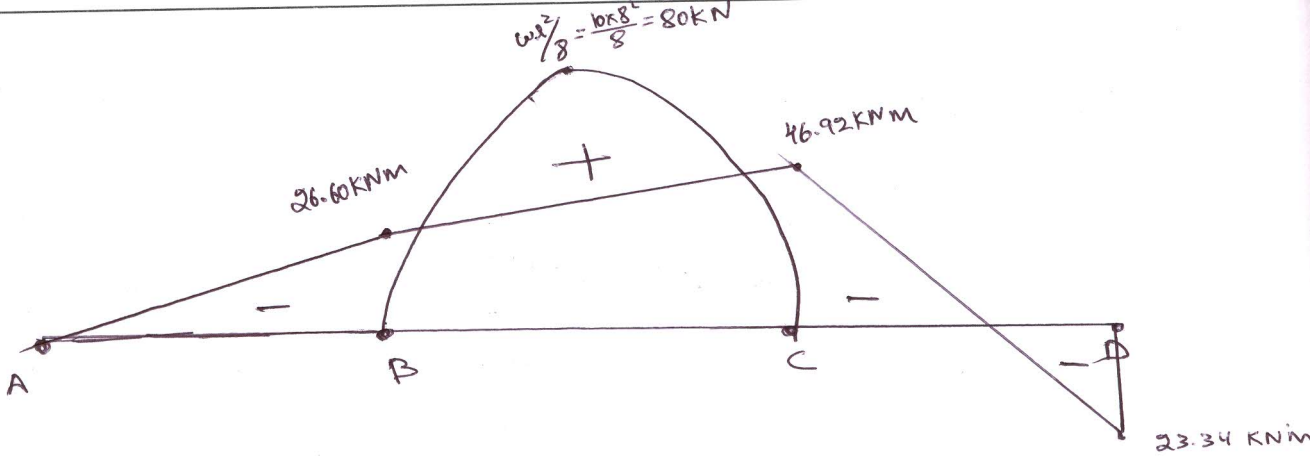
$$\boxed{V_C = 14.25 \text{ KN}}$$

$$\Sigma M_C = 0 \text{ (LHS)}$$

$$46.92 - \cancel{26.60} + \cancel{26.60} + V_B \times 8 + V_A \times 14 = 0$$

$$V_B = \frac{-46.92 - V_A \times 14}{8} = \frac{-46.92 - (-4.43) \times 14}{8}$$

$$V_B = 1.88 \text{ KN}$$



All units of moment are in kNm