Question: Determine the following A and B use VIRTUAL WORK METHO...

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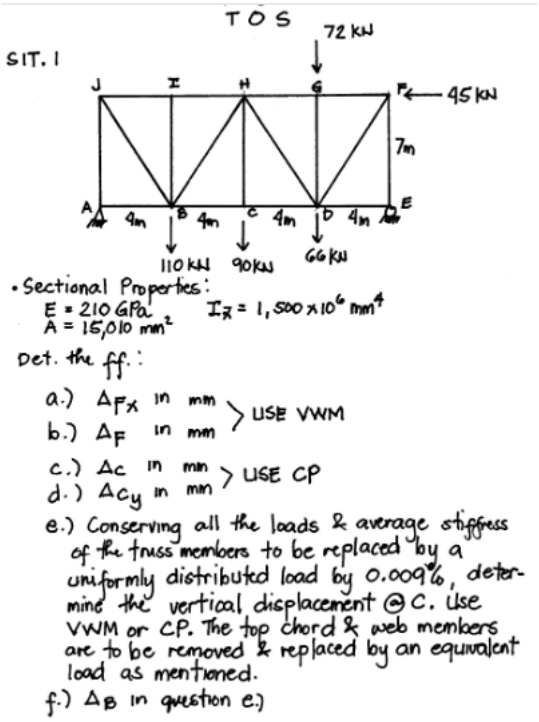
Determine the following

A and B use VIRTUAL WORK METHOD

C and D use CASTIGLIANO'S PRINCIPLE



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Expert Answer

Anonymous answered this
118 answers

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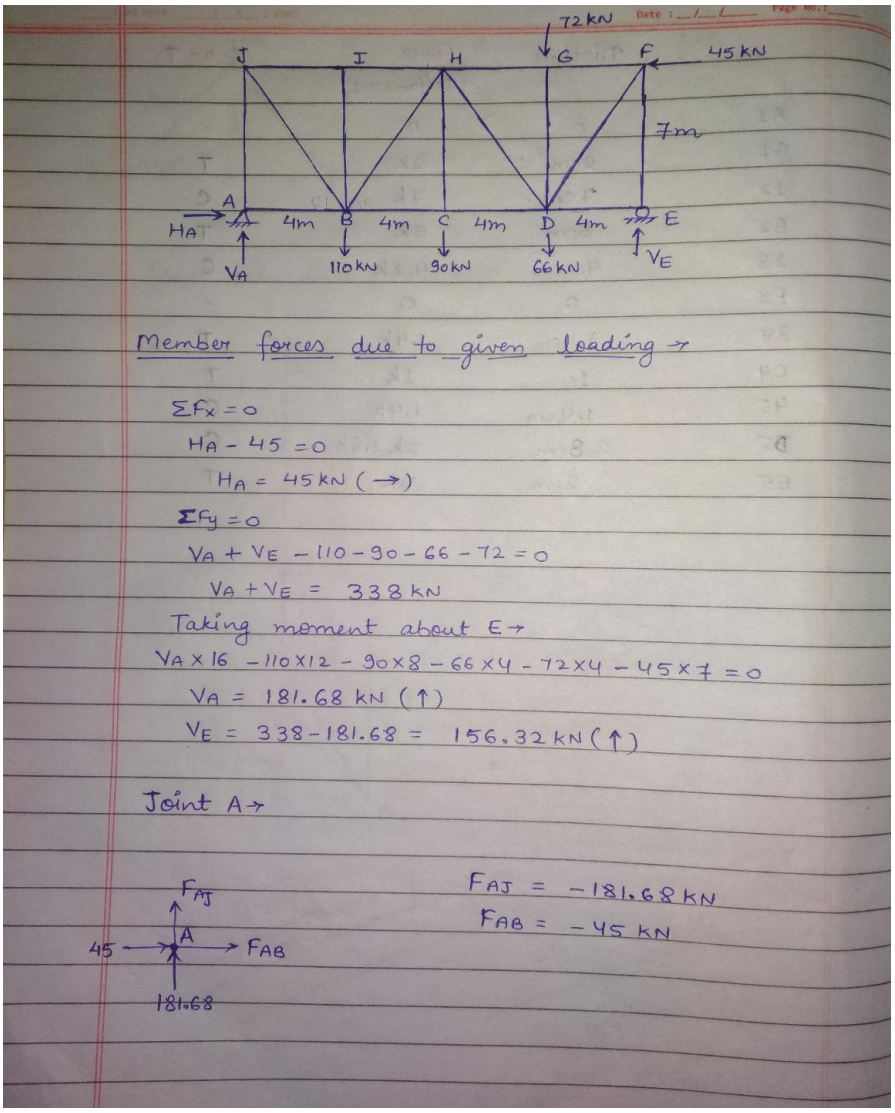


Member forces due to given loading →

$\Sigma F_x = 0$

$H_A - 45 = 0$

$H_A = 45\ kN\ (\rightarrow)$

$\Sigma F_y = 0$

$V_A + V_E - 110 - 90 - 66 - 72 = 0$

$V_A + V_E = 338\ kN$

Taking moment about E →

$V_A \times 16 - 110 \times 12 - 90 \times 8 - 66 \times 4 - 72 \times 4 - 45 \times 7 = 0$

$V_A = 181.68\ kN\ (\uparrow)$

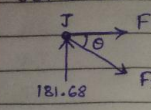
$V_E = 338 - 181.68 = 156.32\ kN\ (\uparrow)$

Joint A →

$F_{AJ} = -181.68\ kN$

$F_{AB} = -45\ kN$

Joint J →



$\theta = \tan^{-1}\left(\frac{7}{4}\right) = 60.25°$

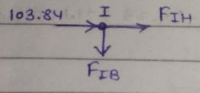
$181.68 - F_{JB} \sin(60.25) = 0$

$F_{JB} = 209.26\ kN$

$F_{JI} + 209.26 \cos(60.25) = 0$

$F_{JI} = -103.84\ kN$

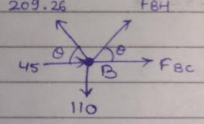
Joint I →



$F_{IH} = -103.84\ kN$

$F_{IB} = 0$

Joint B →



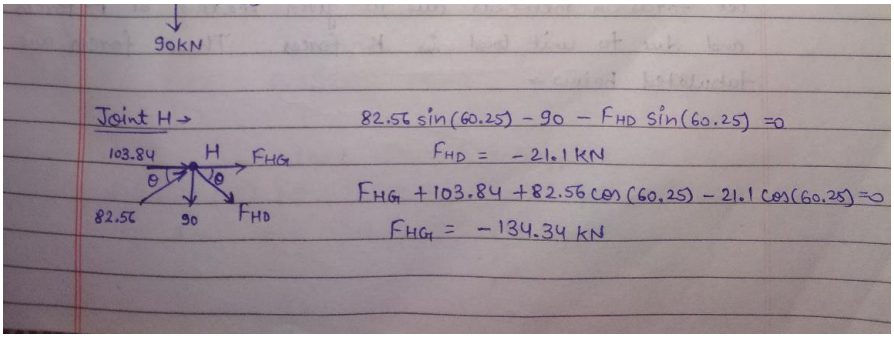
$F_{BH} \sin(60.25) + 209.26 \sin(60.25) - 110 = 0$

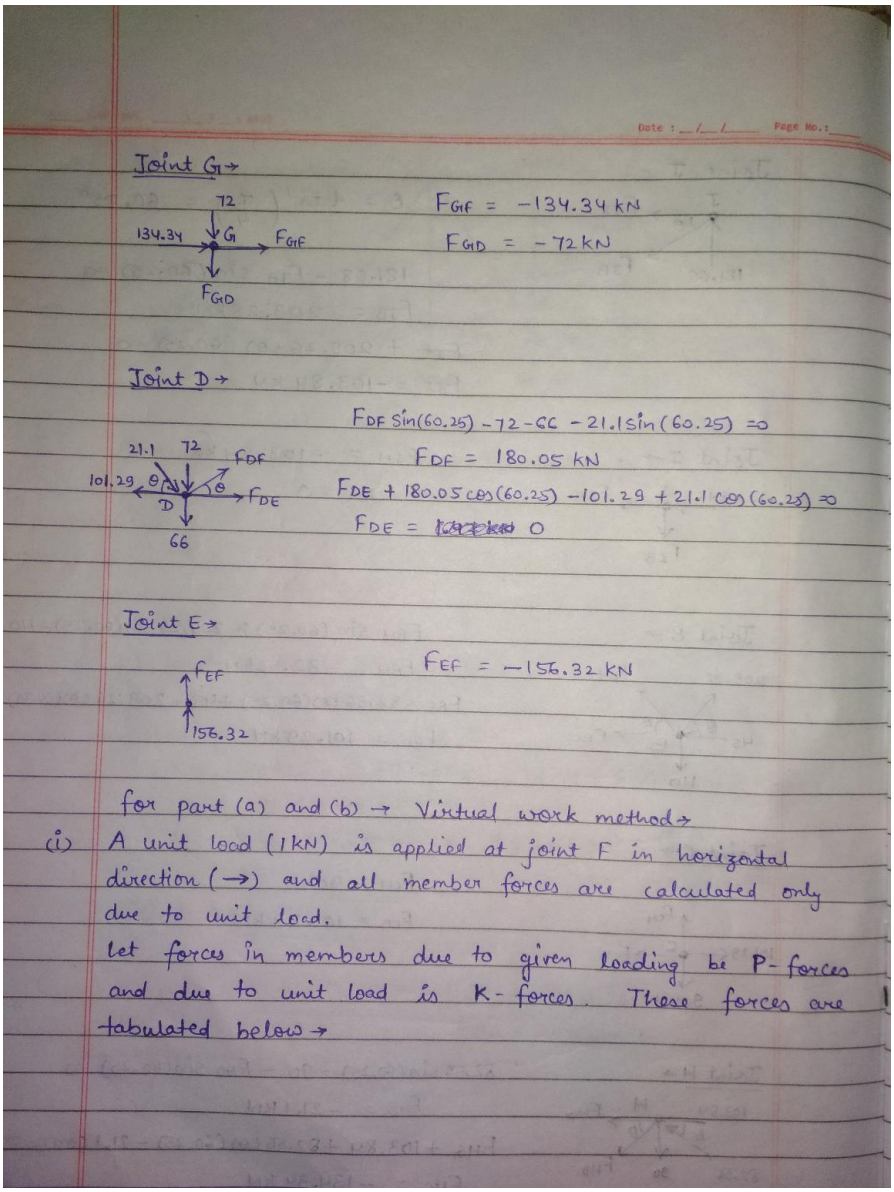
$F_{BH} = -82.56\ kN$

$F_{BC} - 82.56 \cos(60.25) + 45 - 209.26 \cos(60.25) = 0$

$F_{BC} = 101.29\ kN$

Joint C →





Member	Length (m)	P-forces (kN)	K-forces (kN)	$\frac{PKL}{AE}$ (mm)
AB	4	-45	1	-0.057
AJ	7	-181.68	0.437	-0.176
JB	8.06	209.26	-0.5	-0.267
JI	4	-103.84	0.248	-0.033
IH	4	-103.84	0.248	-0.033
IB	7	0	0	0
BH	8.06	-82.56	0.5	-0.105
BC	4	101.29	0.5	0.064
CH	7	90	0	0
CD	4	101.29	0.5	0.064
HD	8.06	-21.1	-0.5	0.027
HG	4	-134.34	0.744	-0.127
GF	4	-134.34	0.744	-0.127
GD	7	-72	0	0
DF	8.06	180.05	0.5	0.230
DE	4	0	0	0
EF	7	-156.32	-0.437	0.152
				-0.388

$\Delta_{Fx} = -0.388$ mm

Negative sign shows that Joint displaced in opposite direction to the applied unit load

$\Delta_{Fx} = 0.388$mm (←)

(ii) Now a unit load of 1kN is applied in vertical direction (↓) at joint F. and similar calculations are done and tabulated below →

Date : / / Page No.:

Member	Length (m)	P-forces (kN)	K-forces (kN)	$\frac{PKL}{AE}$ (mm)
AB	4	-45	0	0
AJ	7	-181.68	0	0
JB	8.06	209.26	0	0
JI	4	-103.84	0	0
IH	4	-103.84	0	0
IB	7	0	0	0
BH	8.06	-82.56	0	0
BC	4	101.29	0	0
CH	7	90	0	0
CD	4	101.29	0	0
HD	8.06	-21.1	0	0
HG	4	-134.34	0	0
Gf	4	-134.34	0	0
GD	7	-72	0	0
Df	8.06	180.05	0	0
DE	4	0	0	0
Ef	7	-156.32	-1	0.347

$\Delta_{fy} = 0.347$ mm (↓)

$\Delta_f = \sqrt{(\Delta_{fx})^2 + (\Delta_{fy})^2}$

$\Delta_f = \sqrt{(0.388)^2 + (0.347)^2}$

$\Delta_f = 0.52$ mm Ans.

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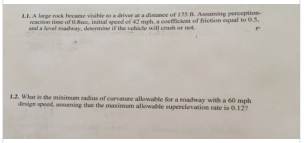
Up next for you in Civil Engineering

Vehicles A and B are traveling toward each other in the opposing lanes on a straight segment of a two-lane highway at 35 and 40 mph

See answer

Need help with all



See answer

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Q: Answer the following. B and C use VIRTUAL WORK METHOD (VWM) D and E use CASTIGLIANO'S PRINCIPLE (CP) Note that Point H is 1m from joint C and the subscript of x in delta H sub x as an example represents horizontal direction while y in delta H sub y as an example represents vertical direction.

Q: 1. A truss shown below is subjected to a horizontal force at joint C. Its axial rigidity, AE=10,000N. - 10N AE = constant USING METHOD OF CONSISTENT DEFORMATIONS FOR INDETERMINATE TRUSSES - ONE REDUNDANT b. Calculate A=[SuL/AE), the relative displacement of joint B and D, due to actual load if member BD (as redundant) is removed?

A: See answer

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