Rotation Example 2

Credit:

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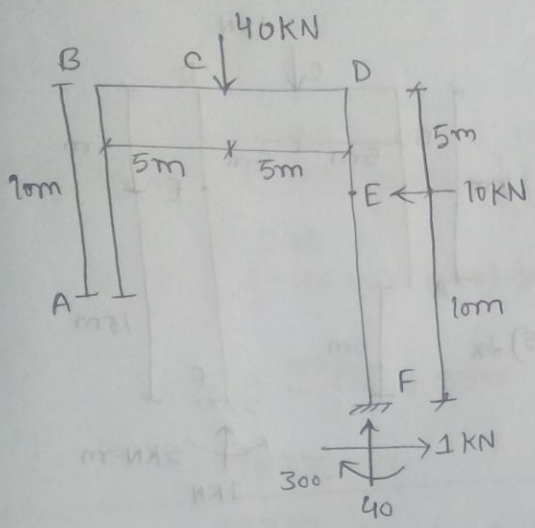
Question: Find

Horizontal deflection at B, Δ_B (h) and rotation at B, θ_B

Vertical deflection at C, Δ_C (v) rotation at C, θ_C

Horizontal deflection at D, Δ_D (h) and rotation at D, θ_D

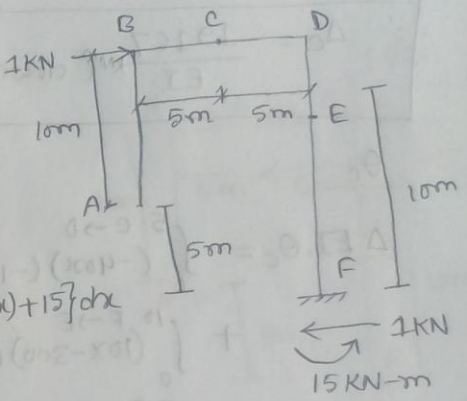


$\Delta B(h)$

$$EI.\,\Delta_B = \int_0^{5\ C\to D} (-40x)\cdot 0\,dx + \int_0^{10\ F\to E} (10x-300)(-1\cdot x+15)\,dx + \int_0^{5\ E\to D} \{-10x+10(10+x)-300\}\{-1(10+x)+15\}\,dx$$

$$= \frac{-77500}{3} - 2500$$

$$= -28333.33$$

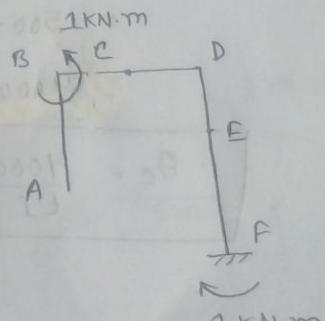


Δ_B (h) = (28333/EI) m, to the left

θ_B

$$EI.\,\theta_B = \int_0^{5\ C\to D} (-40x)(-1)\,dx + \int_0^{10\ F\to E} (10x-300)(-1)\,dx + \int_0^{5\ E\to D} \{-10x+10(10+x)-300\}(-1)\,dx$$

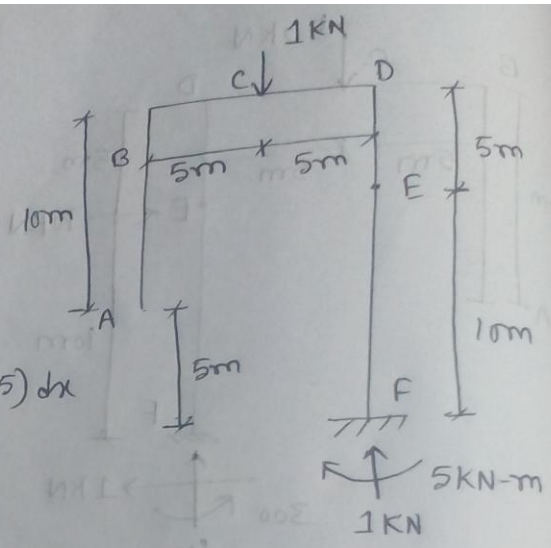
$$= 500 + 2500 + 1000$$



θ_B = (4000/EI) radian, Counter Clockwise

Δ_C (v)

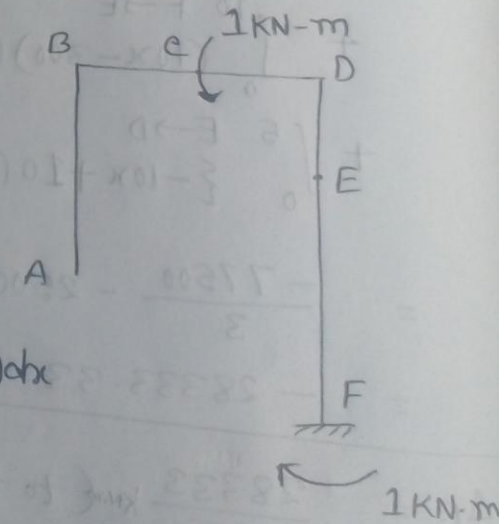
$$EI.\Delta_C = \int_0^5 (-40x)(-1.x)\,dx \quad (C \to D)$$
$$+ \int_0^{10} (10x - 300)(-5)\,dx \quad (F \to E)$$
$$+ \int_0^5 \{-10x + 10(10+x) - 300\}(-5)\,dx \quad (E \to D)$$
$$= \frac{5000}{3} + 12500 + 5000$$
$$= 19166.67$$



Δ_C (v) = (19167/EI) m, downward

θ_C

$$EI.\theta_C = \int_0^5 (-40x)(-1)\,dx \quad (C \to D)$$
$$+ \int_0^{10} (10x - 300)(-1)\,dx \quad (F \to E)$$
$$+ \int_0^5 \{-10x + 10(10+x) - 300\}(-1)\,dx \quad (E \to D)$$
$$= 500 + 2500 + 1000$$
$$= 4000$$



θ_C = (4000/EI) radian, Counter Clockwise

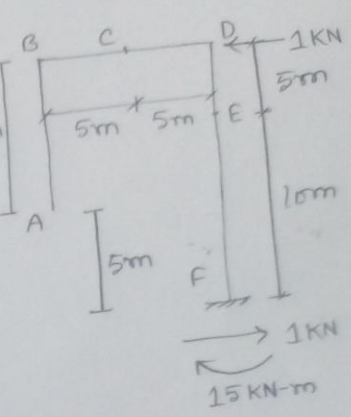
Δ_D (h)

$$EI \cdot \Delta_D = \int_0^{5\ C\to D} (-40x)\cdot 0\,dx + \int_0^{10\ F\to E} (10x-500)(x-15)\,dx + \int_0^{5\ E\to D} \{-10x+10(10+x)-300\}\{1(10+x)-15\}\,dx$$

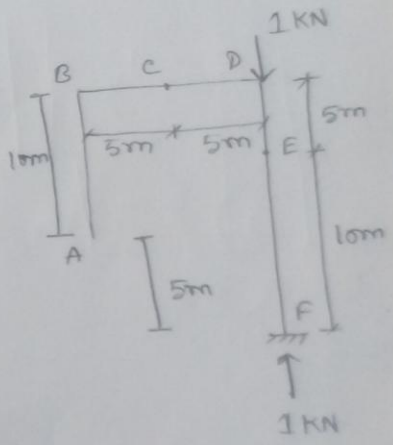
$$= 0 + \frac{77500}{3} + 2500$$

$$= 28333.33$$

$$\therefore \Delta_D = \frac{28333}{EI} \text{ (to the left)}$$



Δ_D (h) = (28333/EI) m, to the left

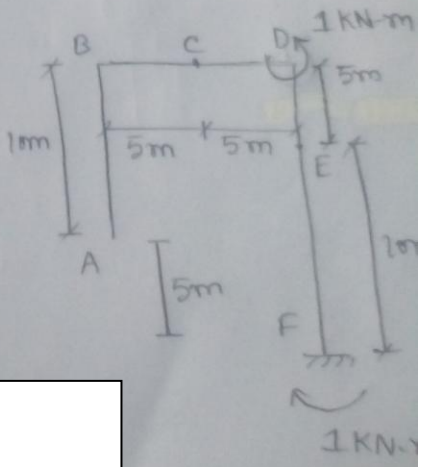


$\therefore \Delta_D = 0$

θ_D

$$EI \cdot \theta_D = \int_0^{5\ C\to D} (-40x)(-1)\,dx + \int_0^{10\ F\to E} (10x-300)(-1)\,dx + \int_0^{5\ E\to D} \{-10x+10(10+x)-300\}(-1)\,dx$$

$$= 500 + 2500 + 1000$$



θ_D = (4000/EI) radian, Counter Clockwise