

ASSIGNMENT No. 3

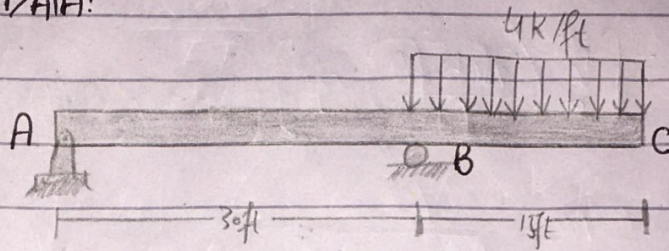
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SECTION : "B"
SUBJECT : STRUCTURAL ANALYSIS
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①

QUESTION No.1

Determine the slope at Point -----
----- Use the moment-area theorem.

GIVEN DATA:



REQUIRED DATA:

We have to find the slope.

SOLUTION:

As we know that

$$\sum M_A = 0 + \uparrow$$

$$\Rightarrow (F_B \times 30) - (60 \times 37.5) = 0$$

$$\Rightarrow \boxed{F_B = 75 \text{ K}}$$

$$\text{Now } \sum F_y = 0 + \uparrow$$

$$\Rightarrow F_A + 75 \text{ K} - 60 \text{ K} = 0$$

$$\Rightarrow \boxed{F_A = -15 \text{ K}}$$

$$\begin{aligned} \text{Now } \theta_{C/A} &= \frac{1}{2} \left(\frac{-75 \text{ K} \cdot \text{ft}}{EI} \right) (45 \text{ ft}) = \frac{33750 \text{ K} \cdot \text{ft}^2}{2EI} \\ &= \frac{16875 \text{ K} \cdot \text{ft}^2}{EI} \end{aligned}$$

(2)

$$|t_{BM}| = \left[\frac{1}{2} \left(\frac{750k \cdot ft}{EI} \right) 30ft \right] \left[\frac{1}{3} (30ft) \right]$$

$$= \frac{112500 k \cdot ft^3}{EI}$$

$$|t_{CM}| = \left[\frac{1}{2} \left(\frac{750k \cdot ft}{EI} \right) 30ft \right] \left[15ft + \frac{1}{3} (30ft) \right] + \left[\frac{1}{2} \left(\frac{750k \cdot ft}{EI} \right) (15ft) \right] \left[\frac{2}{3} (15ft) \right]$$

$$= \frac{281250 k \cdot ft^3}{EI} + \frac{56250 k \cdot ft^3}{EI}$$

$$= \frac{337500 k \cdot ft^3}{EI}$$

Then

$$\Delta = \frac{45}{30} (t_{BM})$$

$$= \frac{45}{30} \left(\frac{112500 k \cdot ft^3}{EI} \right)$$

$$= \frac{168750 k \cdot ft^3}{EI}$$

$$\Delta_A = \frac{|t_{BM}|}{L_{AB}} = \frac{112500 / EI}{30ft}$$

$$= \frac{3750 k \cdot ft^2}{EI}$$

②

$$\rightarrow \Delta_C = \Delta_A + \Delta_{CA}$$

$$\Delta_C = \frac{-3750 \text{ k}\cdot\text{ft}^2}{EI} + \frac{16875 \text{ k}\cdot\text{ft}^3}{EI}$$

$$\Rightarrow \Delta_C = \frac{13125 \text{ k}\cdot\text{ft}^2}{EI}$$

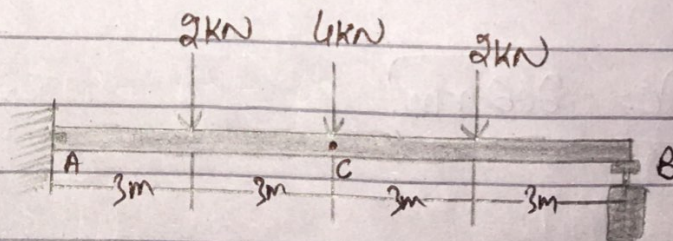
$$\Delta_C = |\Delta_{CA}| - \Delta' = \frac{337500 \text{ k}\cdot\text{ft}^3}{EI} - \frac{168750 \text{ k}\cdot\text{ft}^3}{EI}$$

$$\Delta_C = \frac{168750 \text{ k}\cdot\text{ft}^3}{EI}$$

QUESTION No. 2

Determine the slope at Point - - - - -
- - - - - Take $E = 200 \text{ GPa}$, $I = 6 \times 10^6 \text{ mm}^4$

GIVEN DATA:



$$E = 200 \text{ GPa}$$

$$I = 6 \times 10^6 \text{ mm}^4$$

(4)

Solution:

$$\theta_{A/C} = \frac{1}{2} \left(\frac{12}{EI} \times 3 \right) + \left(\frac{12}{EI} \times 3 \right) + \frac{1}{2} \left(\frac{6}{EI} \times 3 \right)$$

$$\Rightarrow \theta_{A/C} = \frac{63}{EI}$$

$$\Rightarrow \theta_{A/C} = \frac{63}{(200 \times 10^6) (6 \times 10^6) (1/1000)^4}$$

$$\Rightarrow \theta_{A/C} = 0.0525 \text{ radian}$$

$$\begin{aligned} t_{A/C} &= \frac{1}{2} \left(\frac{12}{EI} \times 3 \right) \left(\frac{2 \times 3}{3} \right) + \left(\frac{12}{EI} \times 3 \right) \left(3 + \frac{1}{2} \times 3 \right) \\ &+ \frac{1}{2} \left(\frac{6}{EI} \times 3 \right) \left(3 + \frac{2}{3} \times 3 \right) \end{aligned}$$

$$t_{A/C} = 0.202 \text{ m}$$

$$\Delta_C = t_{A/C} = 0.202 \text{ m}$$

$$\boxed{\Delta_C = 202 \text{ mm}}$$

RESULT :

$$\Delta_C = 202 \text{ mm}$$