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Section = A

Date = 13/07/2020

Assignment # 03

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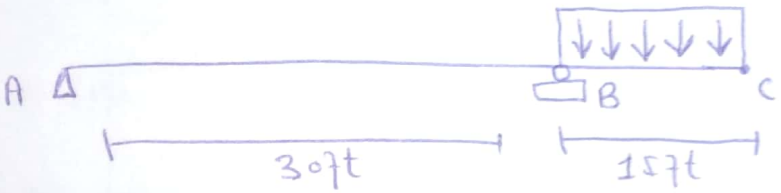
Q# 1:-

Determine the slope and Displacement at C. EI is constant use the moment Area theorams-



Solution:-

$$+\circlearrowleft \Sigma M_A = 0$$

$$-V_B \times 30 + (4 \times 15) \times 3.75 = 0$$

$$V_B = 75k$$

$$\boxed{V_B = 75k}$$

$$\circlearrowright \Sigma M_B = 0$$

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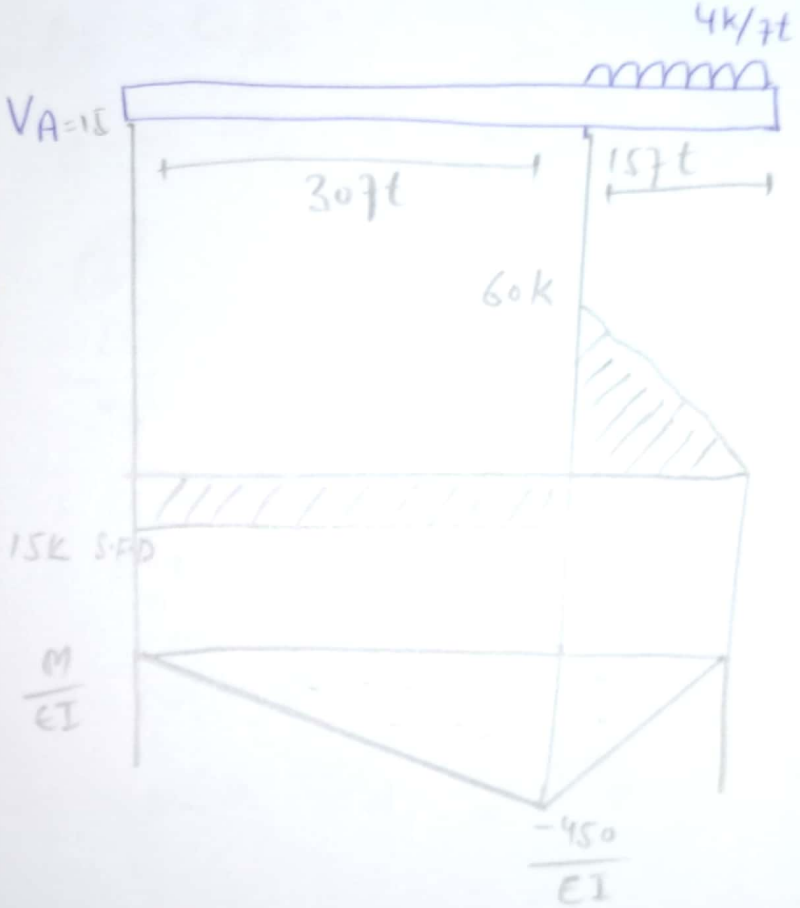
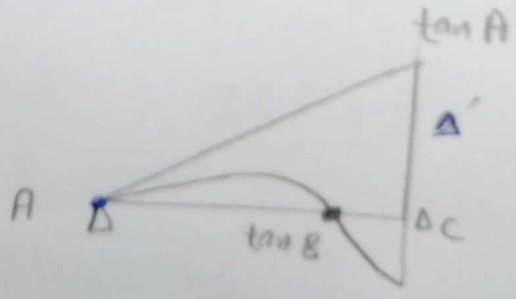
$$V_A \times 30 + (4 \times 15) \times 7.5 = 0$$

$$\boxed{V_A = -15k}$$



Thus M/EI consist of Triangle and Parabola Segment.

For Displacement:-



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$$t_{C/A} = \Delta_C + \Delta'$$

$$\Delta_C = t_{C/A} - \Delta' \rightarrow (1)$$

$$\Delta_C = t_{C/A} - \Delta' \rightarrow (1)$$

$$\frac{\Delta'}{45} = \frac{t_{B/A}}{30}$$

$$\Delta' = \frac{3}{3} t_{B/A}$$

eqn (1)

$$DC = t_{C/A} - \frac{3}{2} t_{B/A}$$

$t_{C/a}$

$$t_{C/a} = \left[\frac{-450}{EI} \times 30 \times \frac{1}{2}\right] \times \left[15 + \frac{1}{3} \times 30\right]$$

$$+ \left[\frac{3}{4} \times 15\right] \times \left[1/3 \times \frac{450}{EI} \times 15\right]$$

$$t_{C/a} = \frac{168750}{EI} - \frac{25312.5}{EI}$$

$$\boxed{t_{C/a} = -194062.5/EI}$$

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For $t_{B/a}$:-

$$t_{B/A} = \left[\frac{-450}{EI} \times \frac{30}{2}\right] \times \left[\frac{1}{3} \times 30\right]$$

$$t_{B/A} = -67500/EI$$

$$DC = \frac{-19406.5}{2} - \left(\frac{67500}{EI}\right) \times 3/2$$

$$DC = \frac{-2953125}{EI} \; k\cdot ft^3$$

For slope at B

$$Q_B = \frac{DC}{15}$$

$$= \left(\frac{2953125}{EI}\right)/15$$

$$Q_B = \frac{19687.5}{EI} \; k/ft^3$$

Slope of the Free end at Point C in nearly equal to Zero

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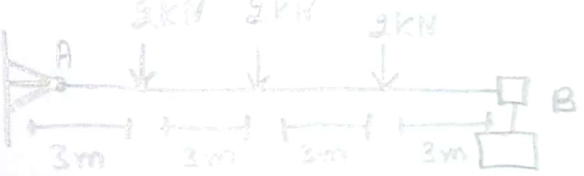
Q#2:-

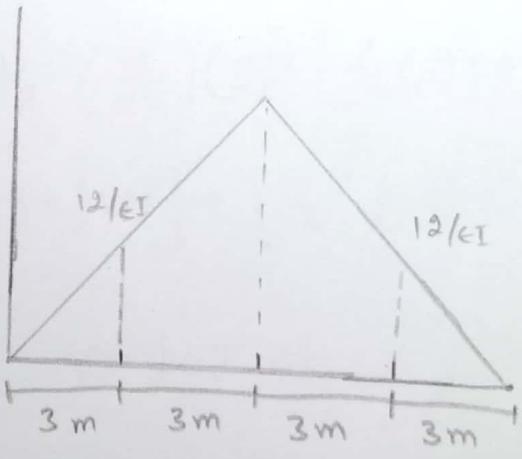
Determine the slope at A and displacement at C of the Beam in the figure moment Area Theorem-

Take $E = 200\ GPa$, $I = 60(10^6)\ mm^4$

Given:-



Solution:-



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

$$\theta_{A/C} = \frac{18}{EI} + \frac{36}{EI} + \frac{9}{EI}$$

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

$$\Rightarrow \frac{63}{(200\times10^6)(6\times10^6)(1000)^{-4}}$$

$$\theta_{A/C} = 0.0525 \text{ rad}$$

$$\boxed{\theta_A = 0.0525 \text{ rad}}$$

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

$$= 0.202 \text{ m}$$

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

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

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