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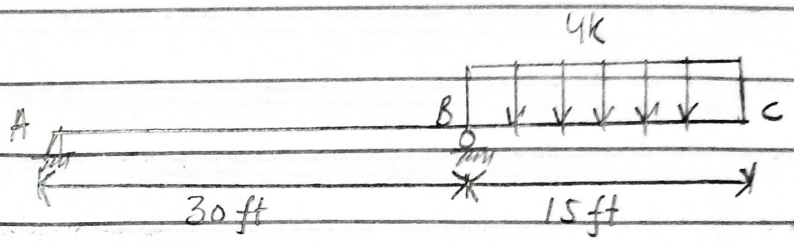
SECTION : B

SEMESTER : 4th

ASSIGNMENT NO; 03

Q:No: 01

" DETERMINE THE SLOP AND DISPLACEMENT at C. USE MOMENT AREA THEORM.



To find;

Slop $(\theta_c) = ?$

Displacement $\Delta_c = ?$

Solution:

Firstly we have to draw M/EI diagram

So;

$\curvearrowright_+ \quad \Sigma M_A = 0$

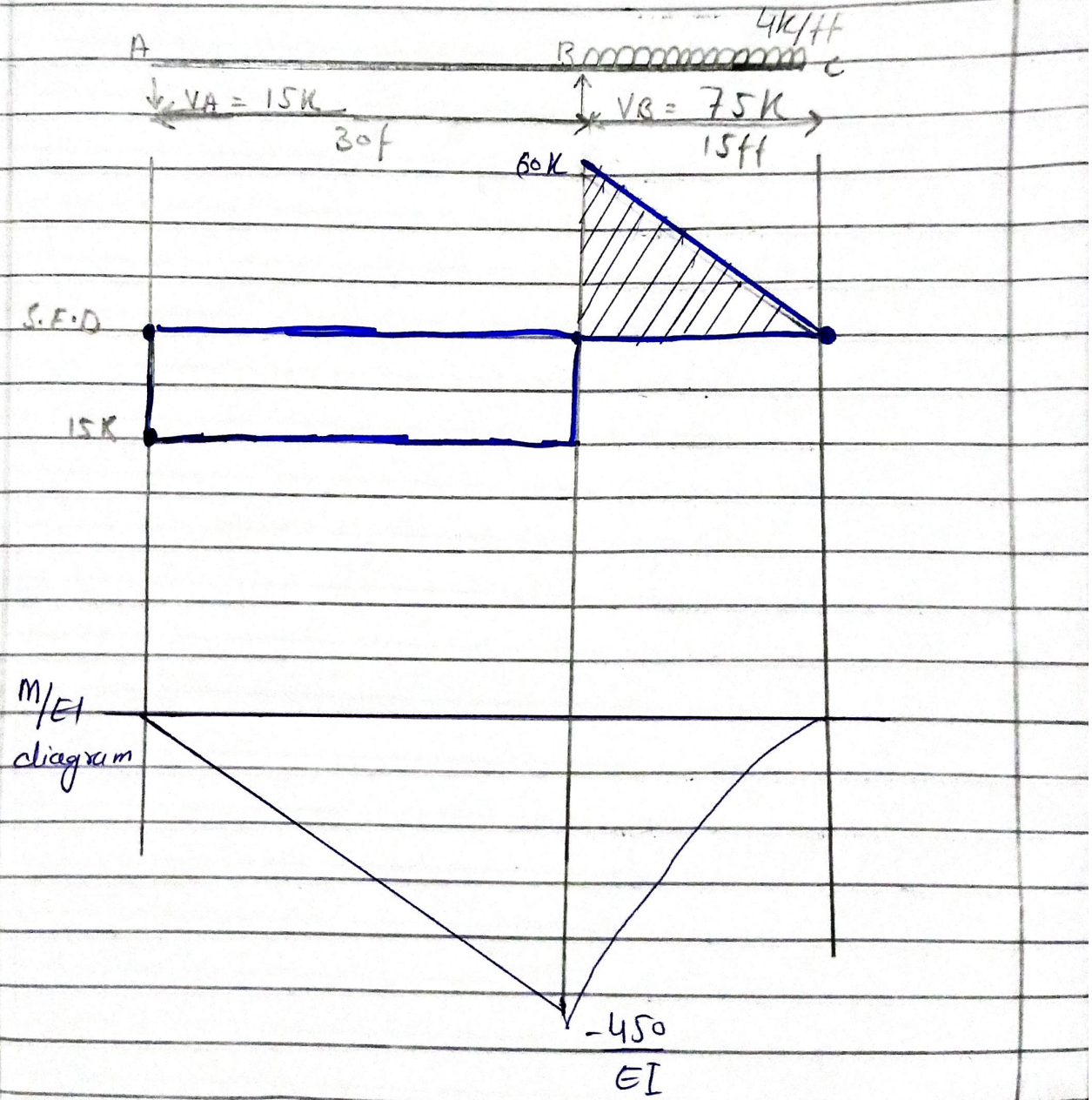
$V_B \times 30 + (4 \times 15) \times 37.5 = 0$

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

$\overset{+}{\circlearrowright} \quad \Sigma M_B = 0$

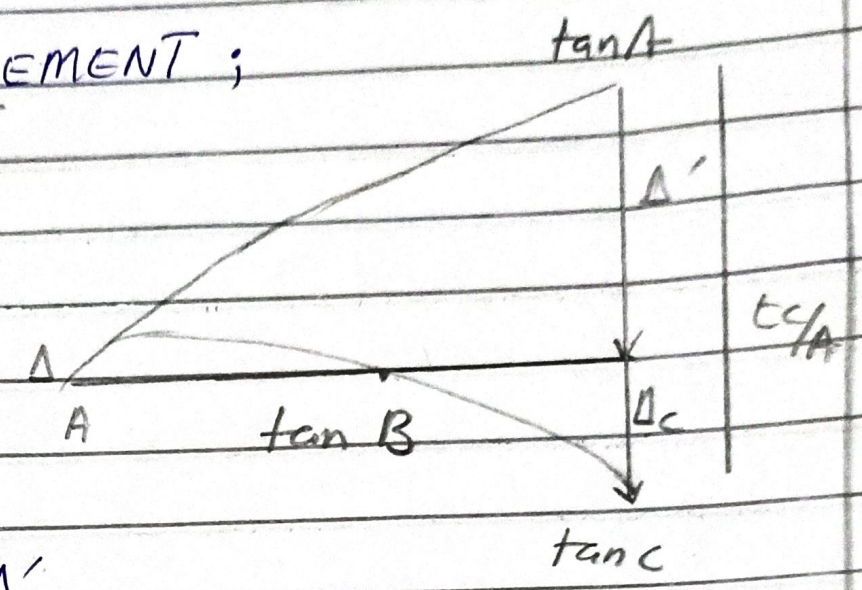
$V_A \times 30 + (4 \times 15) \times 7.5 = 0$

$\rightarrow \quad \boxed{V_A = -15K}$



→ Thus M/EI diagram consists of triangular and parabolic segments.

FOR DISPLACEMENT ;



$$t_{c/A} = \Delta_c + \Delta'$$

$$\Delta_c = t_{c/A} - \Delta'$$

By proportionality of hangers.

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

$$\Delta' = 3/2\ t_{B/A}$$

eq (i) →

$$\Delta_c = t_{c/A} - 3/2\ t_{B/A}$$

or $t_{C/A}$

$$t_{C/A} = \left[-\frac{450}{EI} \times 30 \times \frac{1}{4}\right] \times \left[15 \times \frac{1}{3} \times 3\right] +$$

$$\left[\frac{3}{4} \times 15\right] \times \left[\frac{1}{3} \times \frac{150}{EI} \times 15\right]$$

$$t_{C/A} = -\frac{16875}{EI} - \frac{25312.5}{EI}$$

$$t_{C/A} = -194062.5/EI$$

Now FOR $t_{B/A}$;

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

$$t_{B/A} = -675000/EI$$

Putting the values in eq (ii)

$$\Delta_C = -\frac{194062.5}{2} - \left(\frac{675000}{EI} \times 3/2\right.$$

$$\Delta_C = \frac{295312.5}{EI} \quad K\text{-}ft^3$$

" Now for slop at point B".

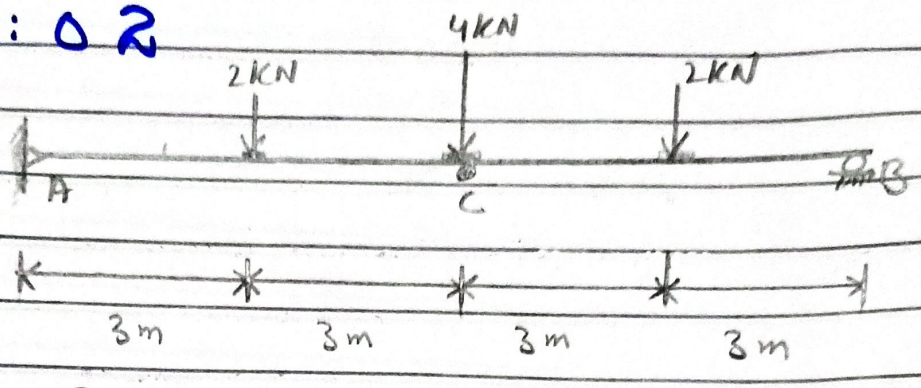
$$\theta_B = \frac{\Delta_C}{15}$$

$$= \frac{295312.5}{EI} \Big/ 15$$

$$\theta_B = \frac{19687.5}{EI} \quad K\text{-}ft^3$$

→ " Slop of the free end e.g. at point C is nearly equal to zero.

Q: No: 02



GIVEN DATA:

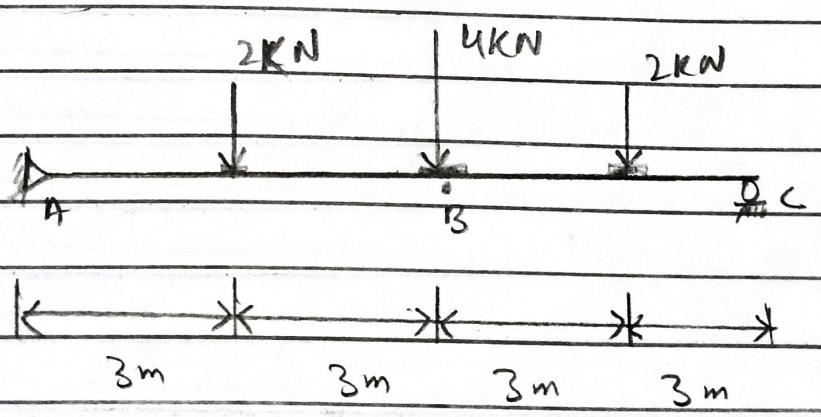
$$E = 200\ GPa$$
$$I = 8 \times 10^6\ mm^4$$

REQUIRED;

Slop at point (θ_A) =>

Deflection at point (D) =>

Solution;

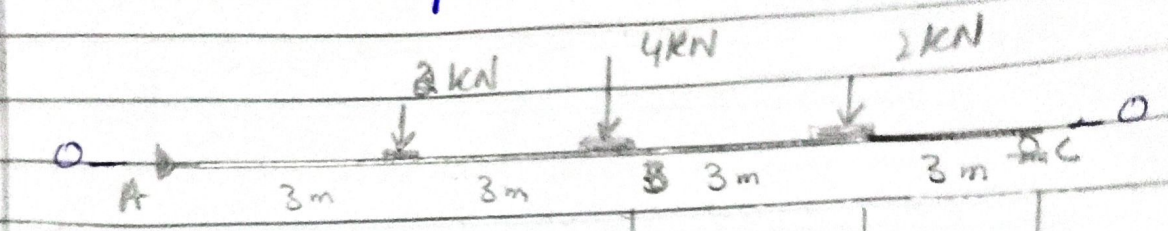


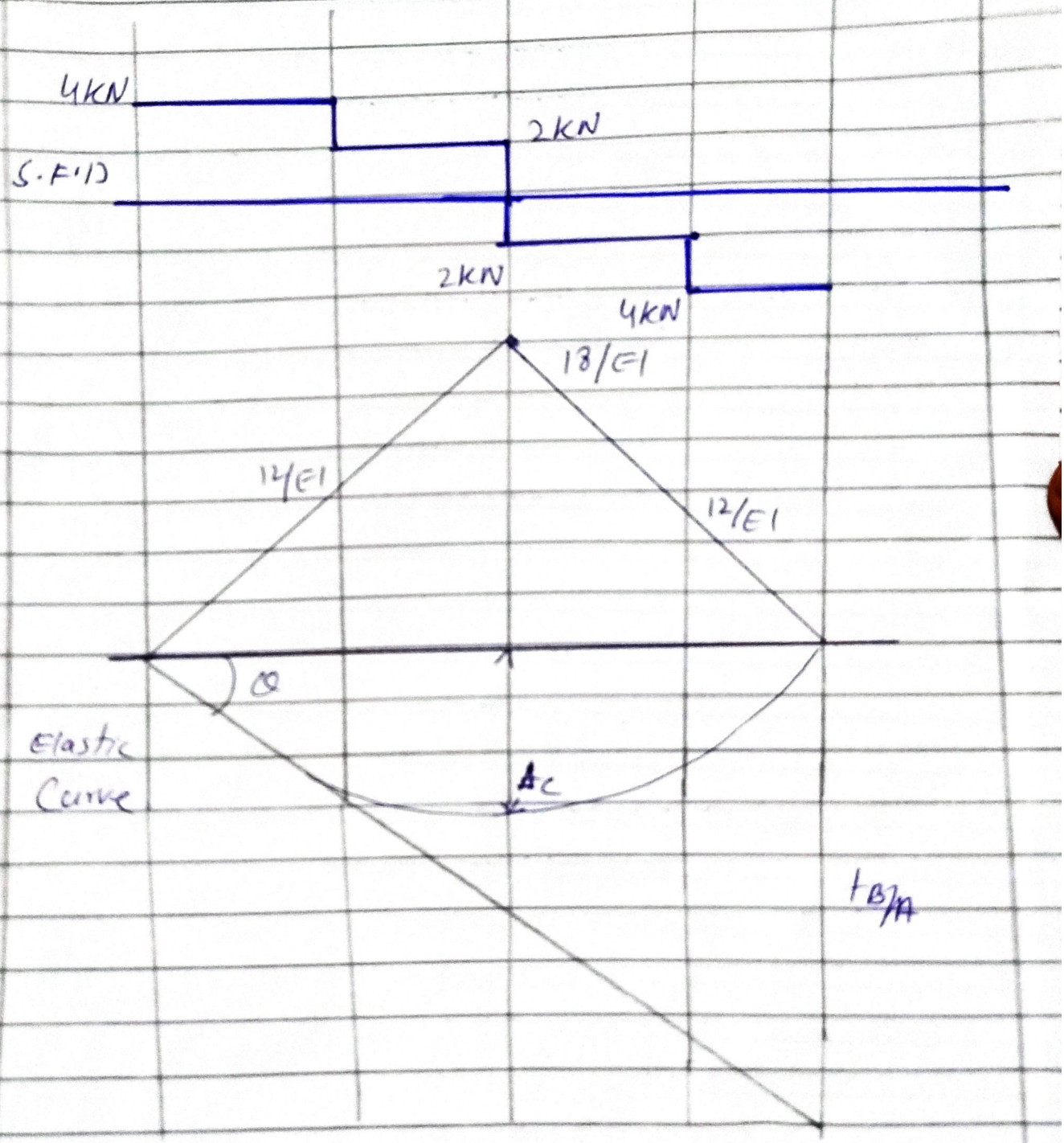
→ As the beam is symmetrical So,

$$V_A = V_B = (2 + 4 + 2)/2$$

$$\boxed{V_A = V_B = 4KN}$$

"FOR M/EI DIAGRAM"





$$\theta_A = \tan_{B/A} / 120 \rightarrow \omega$$

$$\theta_A = \frac{\Delta_C + t_{C/A}}{6}$$

$$\Delta_C = 6\theta_A - t_{r/A} \rightarrow (ii)$$

Now for slop θ_A.

$$t_{B/A} = \int_A^B \frac{M}{EI}\bar{x}$$

$$= \frac{1}{EI}\left[\left(\frac{18\times 6}{2}\right)\left(\frac{2}{3}\times 6\right) + \left(\frac{18\times 6}{2}\right)\times \left(\frac{6\times 6}{3}\right)\right]$$

$$t_{B/A} = \frac{1}{EI}\left[216 + 432\right]$$

$$t_{B/A} = 648/EI$$

eq (i) θ_A $\frac{648}{EI}/12$

$$\theta_A = 54 \text{ KN-m}^2$$

$$= 200\times 10^9 \times \frac{6\times 10^6}{(1000)^4}$$

θ_A = 0.045 (rod anticlockwise)

Now for displacement at pain Δ_C;

$$t_{C/A} = \frac{I}{EI}\left[\left(\frac{18\times 6}{2}\right)\times\left(\frac{1}{3}\times 6\right)\right]$$

$$t_{C/A} = \frac{108}{EI} \quad KN\text{-}m^3$$

eq (ii)

$$\Delta_C = \frac{6\times 54}{EI} - \frac{108}{EI}$$

$$\Delta_C = \frac{324-108}{EI}$$

$$\boxed{\Delta_C = \frac{216}{EI}}$$

$$\Delta_C = \frac{216}{200\times 10^9 \times 6\times (60)^6}$$

$$\Delta_C = 0.18\,m$$

$$\boxed{\Delta_C = 18\,cm \downarrow}$$