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Section "B"

fourth semester

Subject: structural Analysis 1

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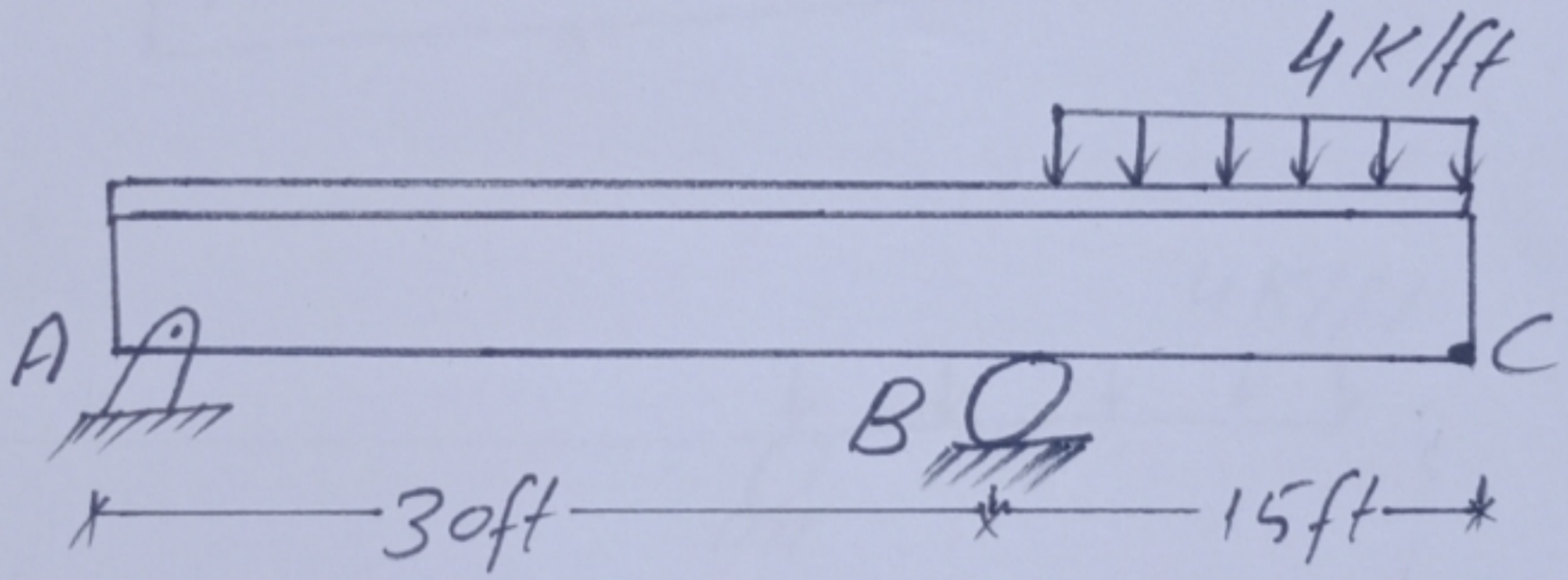
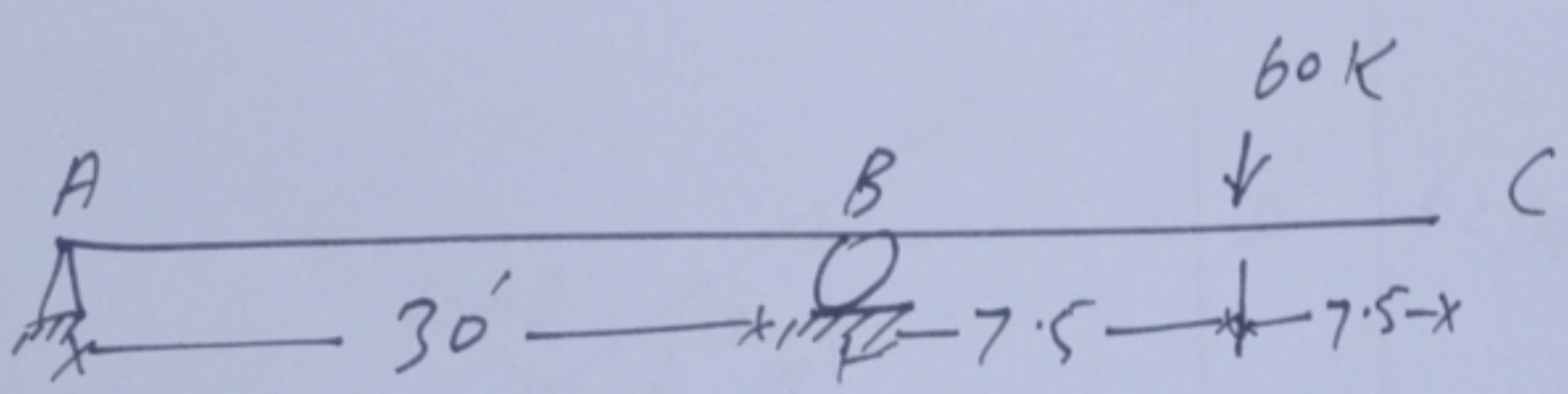
Department of civil Engineering.

Q NO #01: Determine the slope and displacement at C. EI is Constant. Use the moment Area theorm.

Solution:-



First of all we find the Reactions of the supports. For this UDL convert to point Load.



$\zeta + \Sigma M_A = 0$

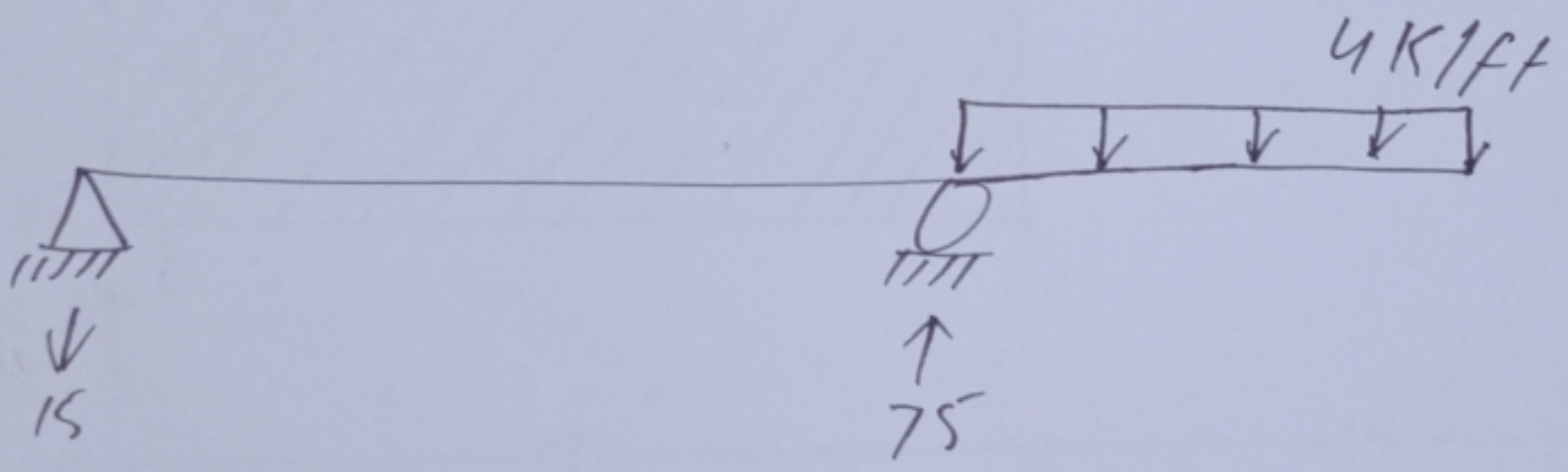
$B \times 30 - 60 \times 37.5 = 0$

$\boxed{B = 75 K \uparrow}$

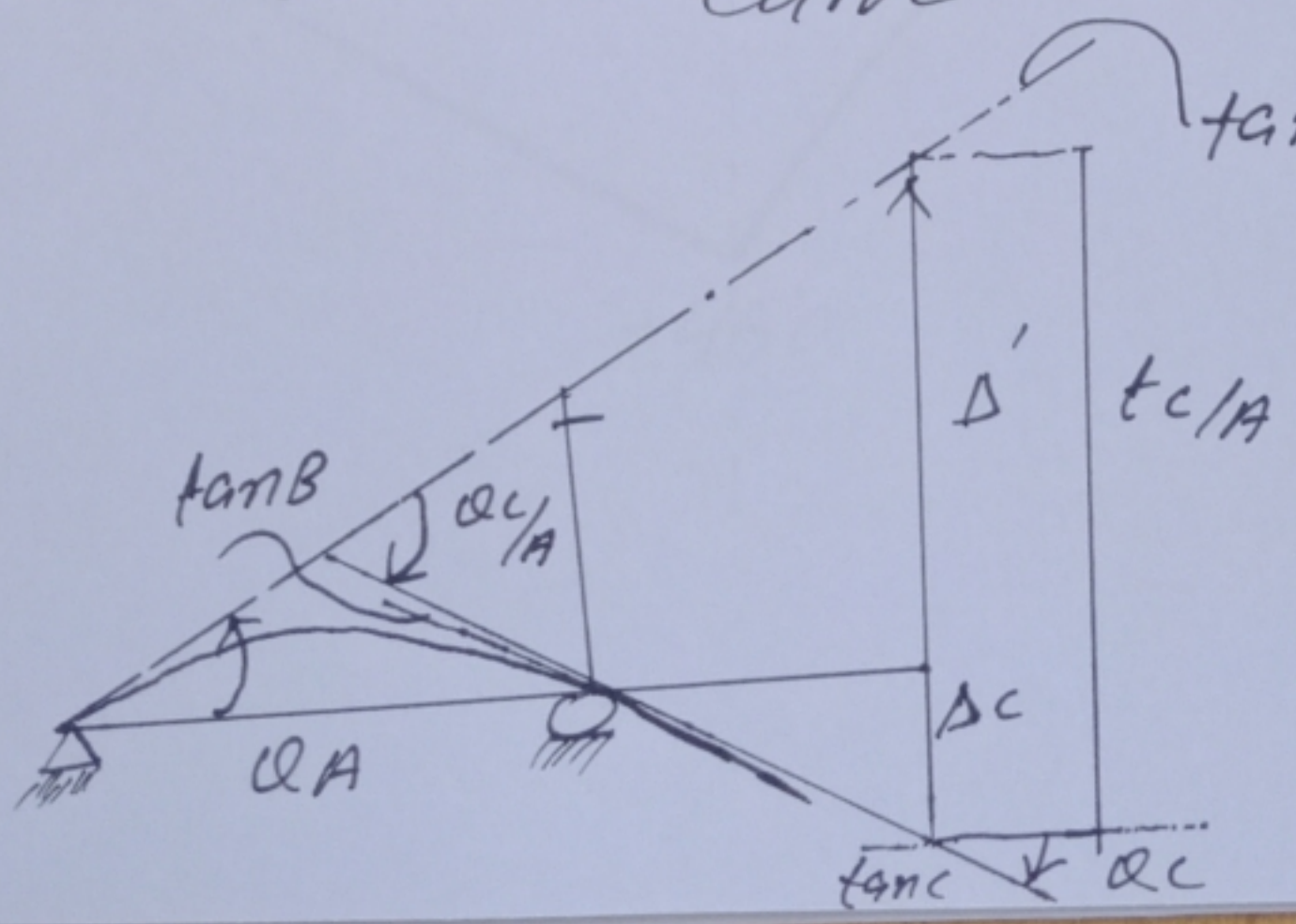
$\zeta + \Sigma m_B = 0;$

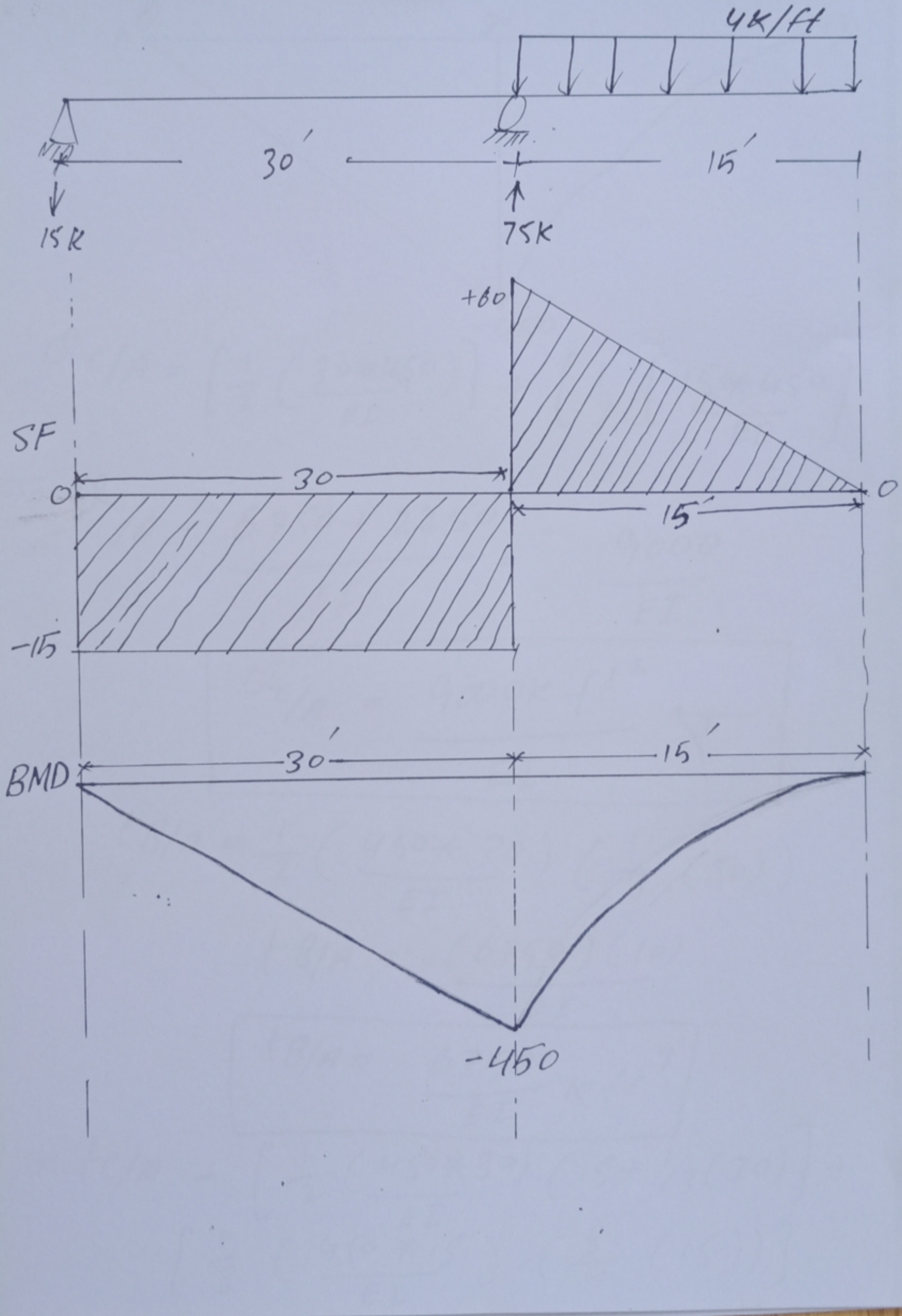
$A \times 30 + 60 \times 7.5 = 0$

$\boxed{A = -15K = 15K \downarrow}$

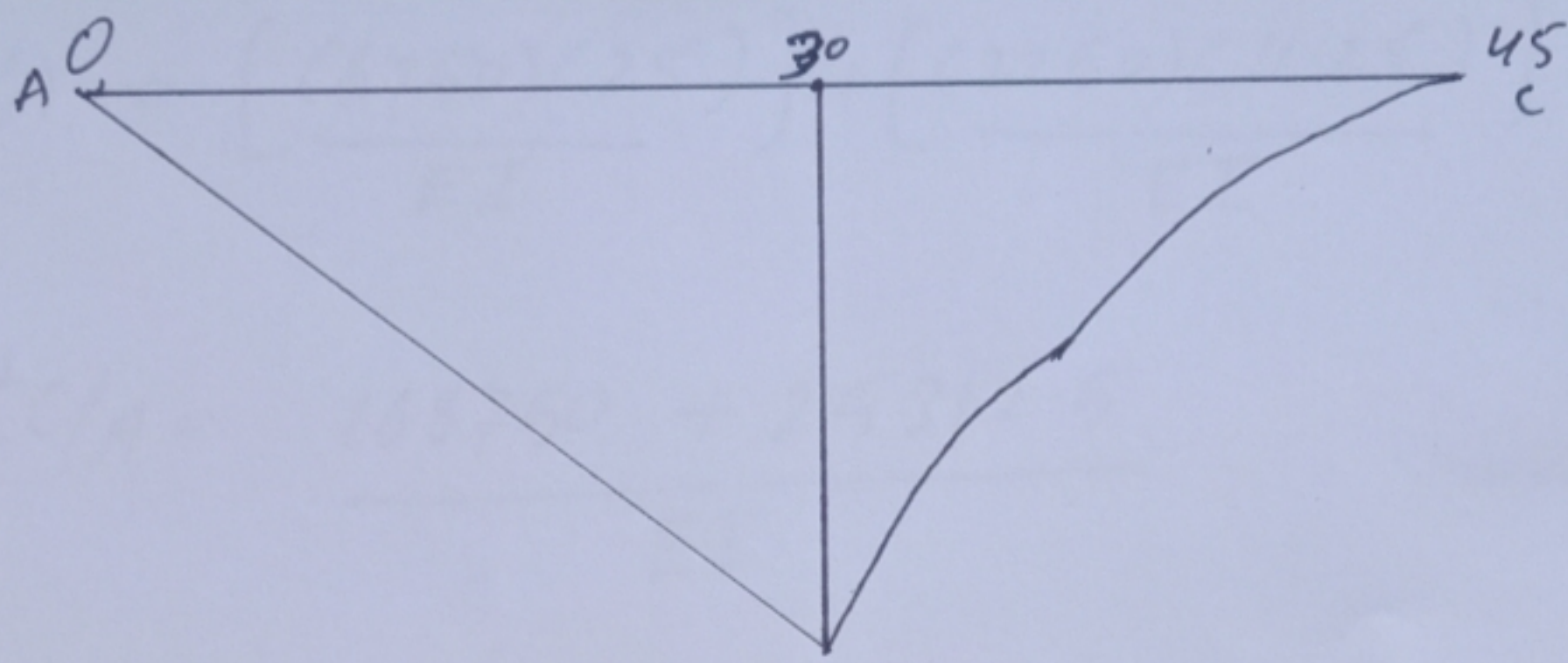


Now we draw Shear force and Bending moment dia-gram. The ~~eg~~ elastic curve.




4K/ft
30'
15'
15K
75K
+60
SF
0
30
0
15'
-15
30'
15'
BMD
-450

(4)



$$\theta_{C/A} = \left[\frac{1}{2}\left(\frac{30*450}{EI}\right)\right] + \left[\frac{1}{3}\left[\frac{15*45^2}{EI}\right]\right]$$

$$\theta_{C/A} = \frac{6750 + 2250}{EI} = \frac{9000}{EI}$$

$$\boxed{\theta_{C/A} = \frac{9000\ k\cdot ft^2}{EI}}$$

$$t_{B/A} = \frac{1}{2}\left(\frac{450*30}{EI}\right)\left(\frac{1}{3}(30)\right)$$

$$t_{B/A} = \frac{(6750)(10)}{EI}$$

$$\boxed{t_{B/A} = \frac{67500}{EI}\ k\cdot ft^3}$$

$$t_{C/A} = \left[\frac{1}{2}\left(\frac{450*30}{EI}\right)(15 + 1/3(30)\right] +$$

$$\left[\frac{1}{3}\left(\frac{450*15}{EI}\right)\left(\frac{3}{4}(15)\right)\right]$$

$$t_{C/A} = \left[\frac{(6750)(25)}{EI}\right] + \left[\frac{(2250)(11.25)}{EI}\right]$$

$$t_{C/A} = \frac{168750 + 25312.5}{EI}$$

$$t_{C/A} = \frac{194062.5}{EI}\ k\cdot ft^3$$

$$\Delta' = \frac{45}{30}(t_{B/A}) = \frac{45}{30}\left(\frac{67500}{EI}\right)$$

$$\Delta' = \frac{101250}{EI}\ k\cdot ft^3$$

$$\theta_A = \frac{t_{B/A}}{L_{AB}} = \frac{67500}{EI\,30} = \frac{2250\ k\cdot ft^2}{EI}$$

$$\theta_A = \frac{2250\ k\cdot ft}{EI}$$

Σ (+↻) $\theta_C = \theta_A + \theta_{C/A}$

$$\theta_C = \frac{2250 + 9000}{EI}$$

$$\theta_C = \frac{11250}{EI} \text{ K·ft}^2$$

Eq $\Delta_C = t_{C/A} - \Delta$

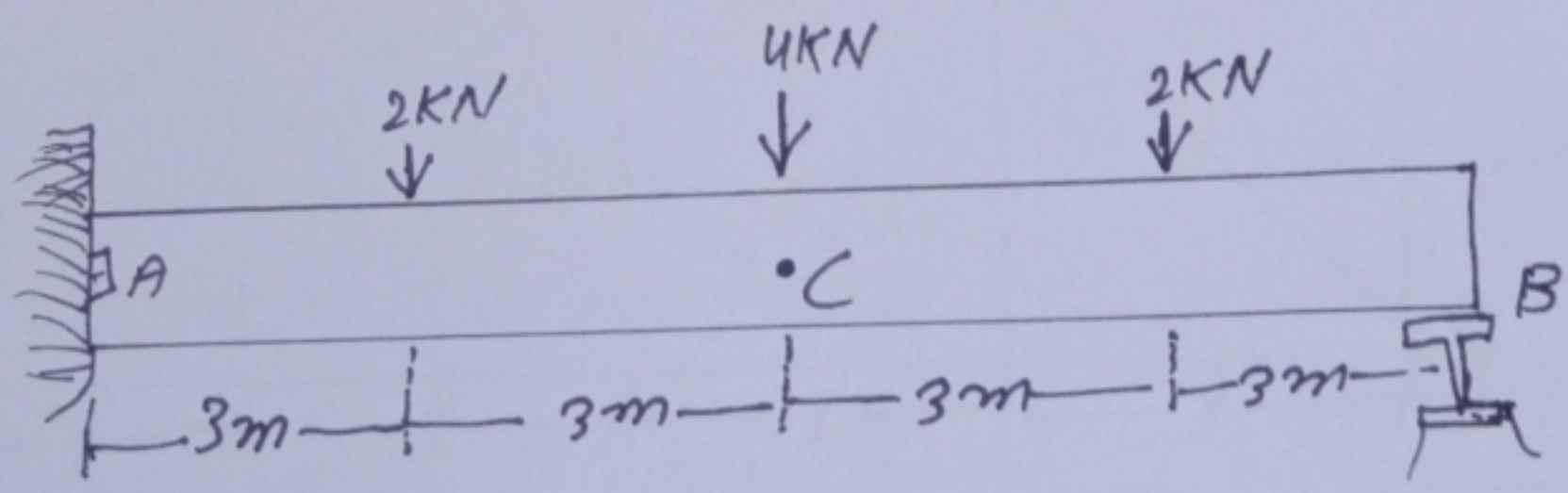
$$\Delta_C = 194062.5 - 101250$$

$$\Delta_C = \frac{92812.5}{EI} \text{ K·ft}^3$$

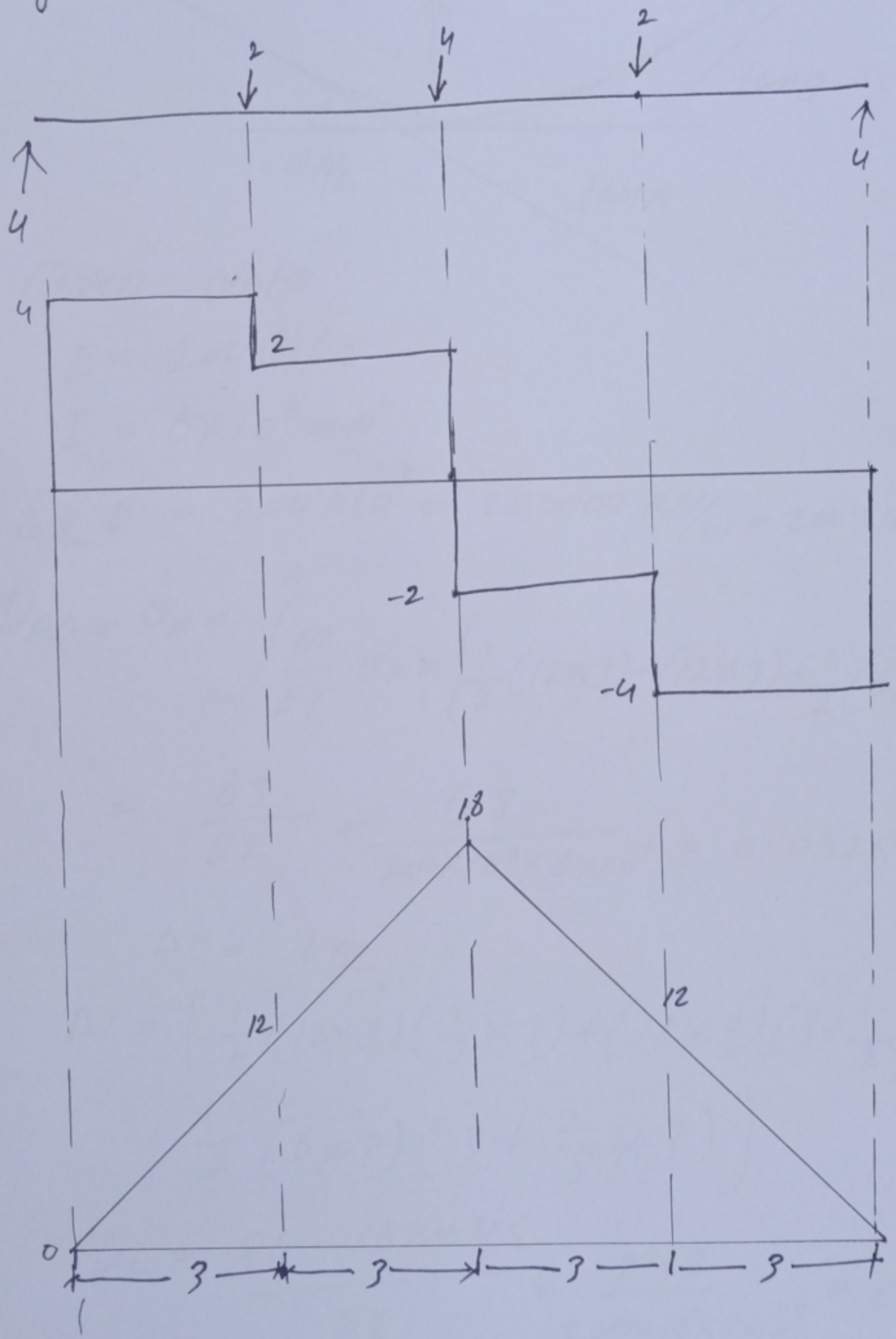
Q NO #02: Determine the slope at a and displacement at C of the beam in the Given figure. using moment. Area. Theorm. Take $E = 200\ GPa = 6(10)^6$

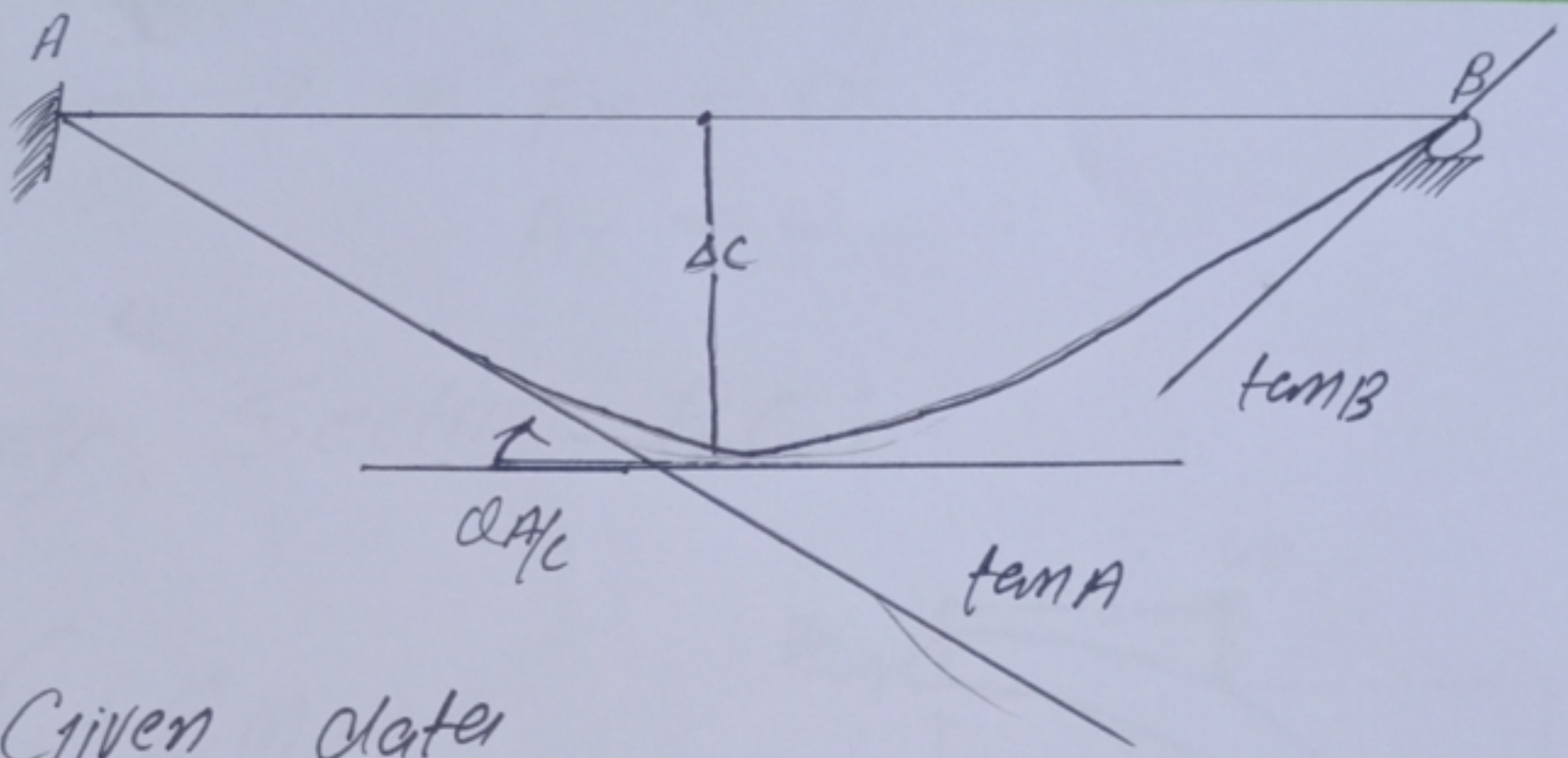
Solution.

Given:-



Shear force and Bending Moment diagram.





Given data

$E = 200\ GPa$

$I = 6 \times 10^6\ mm^4$

$SO\ E = 200 \times 10^3 = 200000\ KN/m = 200 \times 10^6\ KN/m^2$

$$\theta_{A/C} = \theta_A = \int_C^A \frac{m}{EI}\,dx = \left[\frac{1}{2}(12*3)+(12*3)+\frac{1}{2}(6\times 3)\right]\frac{1}{EI}$$

$$= \frac{63}{EI} = \frac{63}{200\times10^6\times6\times10^{-6}} = 0.0525rad$$

$\Delta C = t_{B/C}$

$$\Delta C = \left[\frac{1}{2}(12\times3)\left(\frac{2}{3}*3\right)+(12\times3)\left(3+\frac{1}{2}(3)\right)+\frac{1}{2}(6*3)\left(3+\frac{2}{3}*3\right)\right]$$

$$\Delta C = \frac{36+162+45}{EI} = \frac{243}{200\times10^6\times6\times10^{-6}} = 0.2025m$$