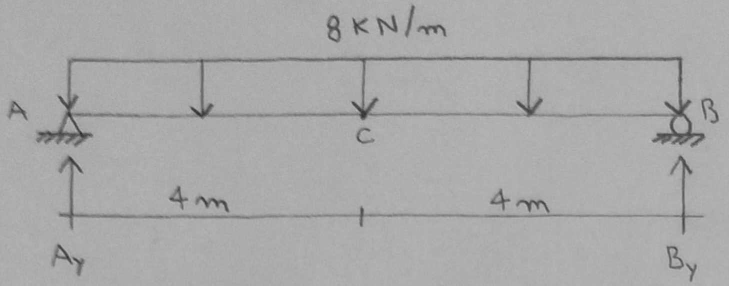
CASTIGLIANO

DETERMINE θ_A y Δ_C



Δ_C

$\Sigma M_A = 0$

$-8(8)(4) + 8B_y - 4P = 0$

$B_y = 32 + 0{,}5P$

$A_y = 32 + 0{,}5P$

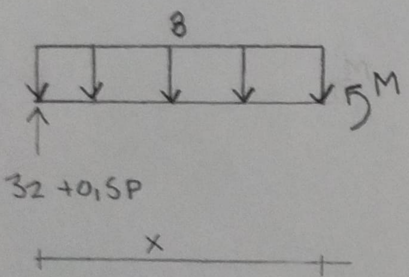
θ_A

$-8(8)(4) + 8B_y + \bar{M} = 0$

$B_y = 32 + \dfrac{\bar{M}}{8}$

$A_y = 32 + \dfrac{\bar{M}}{8}$

Δ_C AB $\rightarrow 0 \leq x \leq 8$



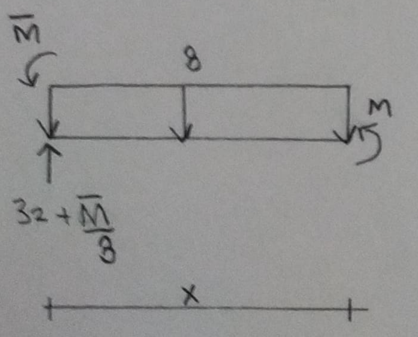
$\Sigma M_v = 0$

$M + 8x\left(\dfrac{x}{2}\right) - x(32 + 0{,}5P) = 0$ $\qquad \dfrac{\partial M}{\partial P} = 0{,}5x$

$M = x(32 + 0{,}5P) - 4x^2$

$M = 32x + 0{,}5Px - 4x^2$

θ_A AB $\rightarrow 0 \leq x \leq 8$



$\Sigma M_v = 0$

$M + 8(x)\left(\dfrac{x}{2}\right) - x\left(32 + \dfrac{\bar{M}}{8}\right) + \bar{M} = 0$ $\qquad \dfrac{\partial M}{\partial P} = \dfrac{x}{8} - 1$

$M = x\left(32 + \dfrac{\bar{M}}{8}\right) - 4x^2 - \bar{M}$

$M = 32x + \dfrac{\bar{M}x}{8} - 4x^2 - \bar{M}$

$$\Delta_C = \int_0^4 2\,(0,5x)(32x - 4x^2)\; dx$$

$$= \int_0^4 32x^2 - 4x^3$$

$$= \left. \frac{32x^3}{3} - \frac{4x^4}{4} \right|_0^4$$

$$\boxed{\Delta_C = \frac{426,67}{EI}\ KN \cdot m^3 \downarrow}$$

$$\theta_A = \int_0^8 \left(\frac{x}{8} - 1\right)(32x - 4x^2)\; dx$$

$$= \int_0^8 \frac{x}{8}(32x) + \frac{x}{8}(-4x^2) - 1(32x) - 1(-4x^2)\; dx$$

$$= \int_0^8 4x^2 - \frac{x^3}{2} - 32x + 4x^2\; dx$$

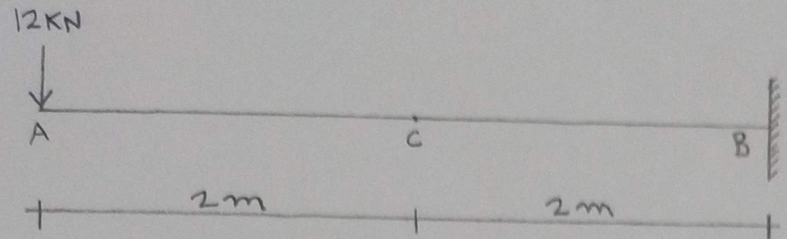
$$= \int_0^8 -\frac{x^3}{2} + 8x^2 - 32x$$

$$= \left. \frac{-x^4}{8} + \frac{8x^3}{3} - 16x^2 \right|_0^8$$

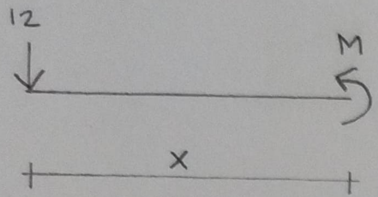
$$\boxed{\theta_A = \frac{170,6}{EI}\ KN \cdot m^2}$$

CASTIGLIANO

DETERMINE θ_c y Δ_c



$AC \rightarrow 0 \leq x \leq 2$



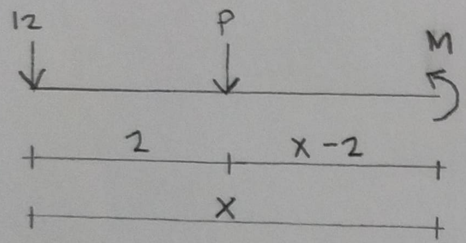
$\Sigma M = 0$

$M + 12x = 0$

$M = -12x$

$\frac{\partial M}{\partial P} = 0$

$\Delta_c \quad AB \rightarrow 0 \leq x \leq 2$



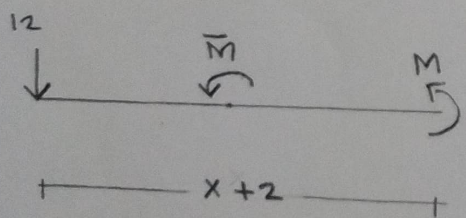
$\Sigma M_v = 0$

$M + P(x-2) + 12x = 0$

$M = -12x - Px - 2P$

$\frac{\partial M}{\partial P} = -x - 2$

$\theta_c \quad AB \rightarrow 0 \leq x \leq 2$



$\Sigma M = 0$

$M + \overline{M} + 12(x+2) = 0$

$M = -\overline{M} - 12(x+2)$

$\frac{\partial M}{\partial P} = -1$

$$\Delta_c = \int_0^2 (-12x)(-x-2)\,dx$$

$$= \int_0^2 12x^2 + 24x\,dx$$

$$= 4x^3 + 12x^2 \Big|_0^2$$

$$\boxed{\Delta_c = \frac{80}{EI}\ KN \cdot m^3 \downarrow}$$

$$\theta_c = \int_0^2 -12(x+2)(-1)\,dx$$

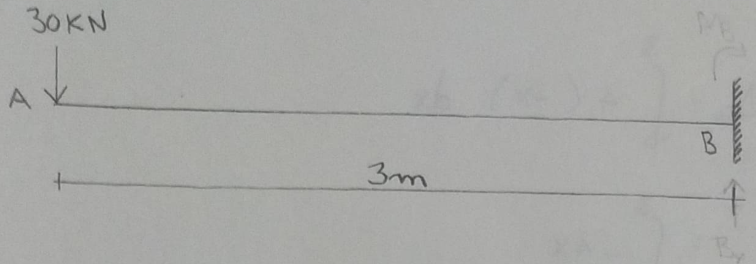
$$= \int_0^2 12x + 24\,dx$$

$$= 6x^2 + 24x \Big|_0^2$$

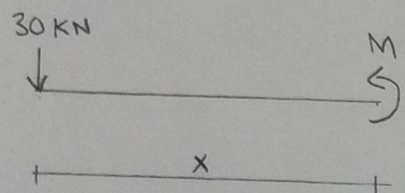
$$\boxed{\theta_c = \frac{72}{EI}\ KN \cdot m^2}$$

TRABAJO VIRTUAL

DETERMINE Δ_A Y θ_A



$AB \rightarrow 0 \leq x \leq 3$

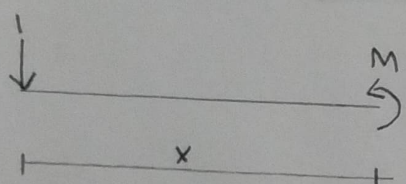


$\Sigma M = 0$

$M + 30x = 0$

$M = -30x$

Δ_A VIRTUAL $AB \rightarrow 0 \leq X \leq 3$

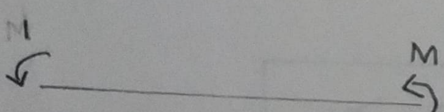


$\Sigma M = 0$

$M + x = 0$

$M = -x$

θ_A VIRTUAL $AB \rightarrow 0 \leq X \leq 3$



$\Sigma M = 0$

$M + 1 = 0$

$M = -1$

$$\Delta_A = \int_0^3 -30x\,(-x)\,dx$$

$$= \int_0^3 30x^2$$

$$= \frac{30x^3}{3}\Big|_0^3$$

$$= 10x^3\Big|_0^3$$

$$\Delta_A = \frac{270}{EI}\ KN \cdot m^3 \downarrow$$

$$\theta_A = \int_0^3 -30x\,(-1)\,dx$$

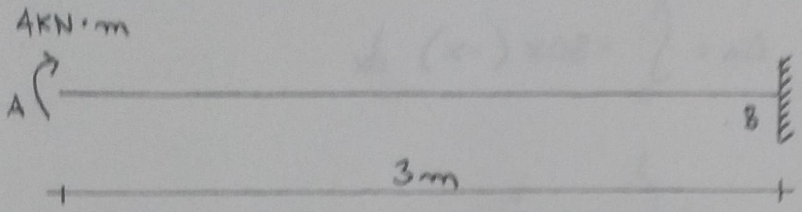
$$= \int_0^3 30x$$

$$= \frac{30x^2}{2}$$

$$= \frac{135}{EI}\ KN \cdot m^2$$

TRABAJO VIRTUAL

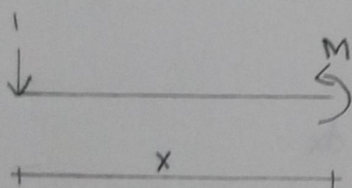
DETERMINE Δ_A y θ_A



$AB \rightarrow 0 \leq x \leq 3$

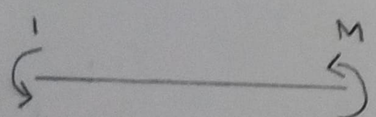
$\Sigma M = 0$
$M - 4 = 0$
$M = 4$

Δ_A VIRTUAL $AB \rightarrow 0 \leq x \leq 3$



$\Sigma M = 0$
$M + 1(x) = 0$
$M = -x$

θ_A VIRTUAL $AB \rightarrow 0 \leq x \leq 3$



$\Sigma M = 0$
$M + 1 = 0$
$M = -1$

$$\Delta_A = \int_0^3 4(-x)\, dx$$

$$= \int_0^3 -4x$$

$$= \frac{-4x^2}{2} \Big|_0^3$$

$$= -2x^2 \Big|_0^3$$

$$\boxed{\Delta_A = \frac{18}{EI} \; KN \cdot m^3 \uparrow}$$

$$\theta_A = \int_0^3 4(-1)\, dx$$

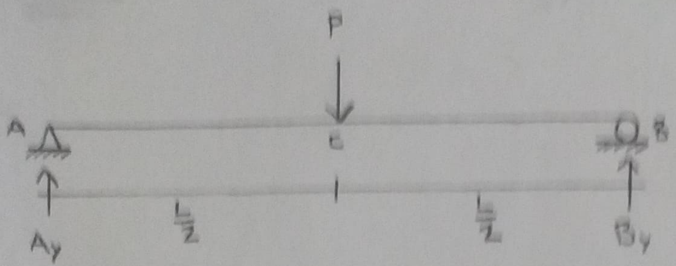
$$= \int_0^3 -4$$

$$= -4x \Big|_0^3$$

$$\boxed{\theta_A = \frac{12}{EI} \; KN \cdot m^2}$$

DOBLE INTEGRACIÓN

DETERMINE LA ECUACIÓN DE LA CURVA ELÁSTICA



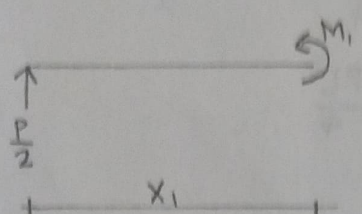
$\Sigma M_A = 0$

$-P\left(\frac{L}{2}\right) + B_y L = 0$

$B_y = \frac{PL}{2}\left(\frac{1}{L}\right)$

$B_y = \frac{P}{2} \uparrow \qquad A_y = \frac{P}{2} \uparrow$

TRAMO I $\rightarrow$ $0 \leq X_1 \leq \frac{L}{2}$

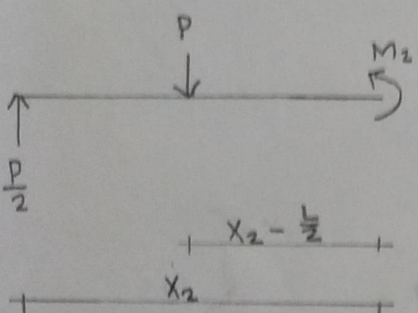


$\Sigma M = 0$

$M_1 - \frac{P}{2}(X_1) = 0$

$M_1 = \frac{P}{2}(X_1)$

TRAMO II $\rightarrow$ $\frac{L}{2} \leq X_2 \leq L$



$\Sigma M = 0$

$M_2 + P\left(X_2 - \frac{L}{2}\right) - \frac{P}{2} X_2 = 0$

$M_2 = \frac{P}{2} X_2 - PX_2 + \frac{PL}{2}$

$M_2 = \frac{-PX_2}{2} + \frac{PL}{2}$

$EI\,\theta^{I} = \int \frac{P}{2}(X_1)\,dx \Rightarrow EI\,\theta^{I} = \frac{PX_1^2}{4} + C_1$ (1)

$EI\,\Delta^{I} = \int \frac{PX_1^2}{4} + C_1\,dx \Rightarrow EI\,\Delta^{I} = \frac{PX_1^3}{12} + C_1 X + C_2$ (2)

$EI\,\theta^{II} = \int \frac{-PX_2}{2} + \frac{PL}{2}\,dx \Rightarrow EI\,\theta^{II} = \frac{-PX_2^2}{4} + \frac{PLX_2}{2} + C_3$ (3)

$EI\,\Delta^{II} = \int \frac{-PX_2^2}{4} + \frac{PLX_2}{2} + C_3 \Rightarrow EI\,\Delta^{II} = \frac{-PX_2^3}{12} + \frac{PLX_2^2}{4} + C_3 X_2 + C_4$ (4)

$X = 0 \qquad \Delta^{I} = 0$

$$EI\,\Delta^{I} = \frac{PX_1^3}{12} + C_1 X + C_2 \Rightarrow EI(0) = \frac{P(0)^3}{12} + C_1(0) + C_2 \Rightarrow \underline{\underline{C_2 = 0}}$$

PRINCIPIO DE CONTINUIDAD TRAMO I y II

$$\theta^{I}_{x=\frac{L}{2}} = \theta^{II}_{x=\frac{L}{2}}$$

$$\frac{PX^2}{4} + C_1 = \frac{-PX^2}{4} + \frac{PLX}{2} + C_3 \Rightarrow \frac{P\left(\frac{L}{2}\right)^2}{4} + C_1 = \frac{-P\left(\frac{L}{2}\right)^2}{4} + \frac{PL\left(\frac{L}{2}\right)}{2} + C_3$$

$$\frac{PL^2}{16} + C_1 = \frac{-PL^2}{16} + \frac{PL^2}{4} + C_3 \Rightarrow C_1 - C_3 = \frac{-PL^2}{16} - \frac{PL^2}{16} + \frac{PL^2}{4}$$

$$C_1 - C_3 = \frac{PL^2}{8} \qquad (5)$$

$$\Delta^{I}_{x=6} = \Delta^{II}_{x=6}$$

$$\frac{PX^3}{12} + C_1 X = -\frac{PX^3}{12} + \frac{PLX^2}{4} + C_3 X + C_4$$

$$\frac{P\left(\frac{L}{2}\right)^3}{12} + C_1\left(\frac{L}{2}\right) = \frac{-P\left(\frac{L}{2}\right)^3}{12} + \frac{PL\left(\frac{L}{2}\right)^2}{4} + C_3\left(\frac{L}{2}\right) + C_4$$

$$\frac{PL^3}{96} + C_1\left(\frac{L}{2}\right) = \frac{-PL^3}{96} + \frac{PL^3}{16} + C_3\left(\frac{L}{2}\right) + C_4$$

$$\frac{PL^3}{96} + C_1\left(\frac{L}{2}\right) - C_3\left(\frac{L}{2}\right) + \frac{PL^3}{96} - \frac{PL^3}{16} = C_4 \Rightarrow C_4 = \frac{-PL^3}{24} + \frac{L}{2}(C_1 - C_3)$$

$$C_4 = \frac{-PL^3}{24} + \frac{L}{2}\left(\frac{PL^2}{8}\right)$$

$$\underline{C_4 = \frac{PL^3}{48}}$$

$X = L \qquad \Delta^{II} = 0$

$$EI\,\Delta^{II} = \frac{-PX^3}{12} + \frac{PLX^2}{4} + C_3 X + C_4$$

$$0 = \frac{-PL^3}{12} + \frac{PL(L)^2}{4} + C_3(L) + \left(\frac{PL^3}{48}\right)$$

$$0 = \frac{-PL^3}{12} + \frac{PL^3}{4} + C_3(L) + \frac{PL^3}{48}$$

$$C_3 = -\frac{3PL^2}{16}$$

$$C_1 - C_3 = \frac{PL^2}{8}$$

$$C_1 = \frac{PL^2}{8} - \frac{3PL^2}{16}$$

$$C_1 = \frac{-PL^2}{16}$$

$$EI\,\Delta^{I} = \frac{PX^3}{12} + C_1 X + C_2 \Rightarrow \Delta^{I} = \left(\frac{PX^3}{12} + \left(\frac{-PL^2}{16}\right)X\right)\frac{1}{EI} \qquad (2)$$

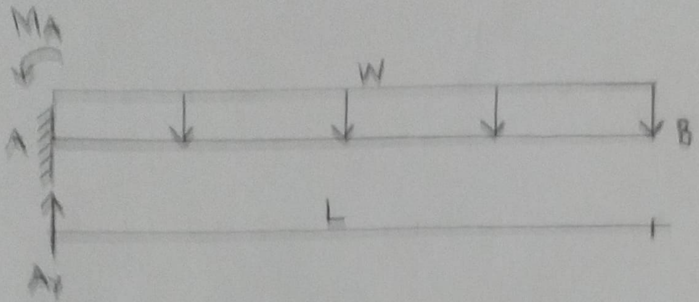
$$EI\,\theta^{I} = \frac{PX^2}{4} + C_1 \Rightarrow \theta^{I} = \left(\frac{PX^2}{4} + \left(\frac{-PL^2}{16}\right)\right)\frac{1}{EI} \qquad (1)$$

$$EI\,\Delta^{II} = \frac{-PX^3}{12} + \frac{PLX^2}{4} + C_3 X + C_4 \Rightarrow \Delta^{II} = \frac{\frac{-PX^3}{12} + \frac{PLX^2}{4} - \left(\frac{3PL^2}{16}\right) + \left(\frac{PL^3}{48}\right)}{EI}$$

$$EI\,\theta^{II} = \frac{-PX^2}{4} + \frac{PLX}{2} + C_3 \Rightarrow \theta^{II} = \frac{\frac{-PX^2}{4} + \frac{PLX}{2} - \frac{3PL^2}{16}}{EI}$$

Doble Integración

DETERMINE LA ECUACION DE LA CURVA ELASTICA.



$$\Sigma M_A = 0$$

$$M_A - WL\left(\frac{L}{2}\right) = 0$$

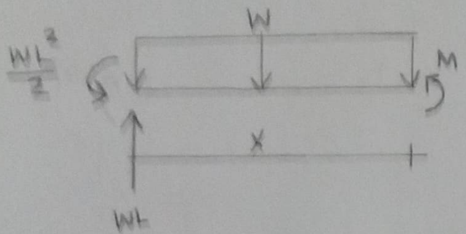
$$M_A = \frac{WL^2}{2}$$

$$\Sigma F_y = 0$$

$$A_y - WL$$

$$A_y = WL$$

TRAMO I ← $0 \leq x \leq L$



$$\Sigma M = 0$$

$$\frac{WL^2}{2} - WLx + Wx\left(\frac{x}{2}\right) + M = 0$$

$$M = -\frac{WL^2}{2} - \frac{Wx^2}{2} + WLx$$

$$EI\,\theta = \int \frac{-WL^2}{2} - \frac{Wx^2}{2} + WLx = \frac{-WL^2x}{2} - \frac{Wx^3}{6} + \frac{WLx^2}{2} + C_1$$

$$EI\,\Delta = \int \frac{-WL^2x}{2} - \frac{Wx^3}{6} + \frac{WLx^2}{2} + C_1 = \frac{-WL^2x^2}{4} - \frac{Wx^4}{24} + \frac{WLx^3}{6} + C_1x + C_2$$

$x = 0 \qquad \Delta = 0$

$$EI\,\Delta = \frac{-WL^2x^2}{4} - \frac{Wx^4}{24} - \frac{WLx^3}{6} + C_1x + C_2 \Rightarrow \underline{\underline{C_2 = 0}}$$

$x = 0 \qquad \theta = 0$

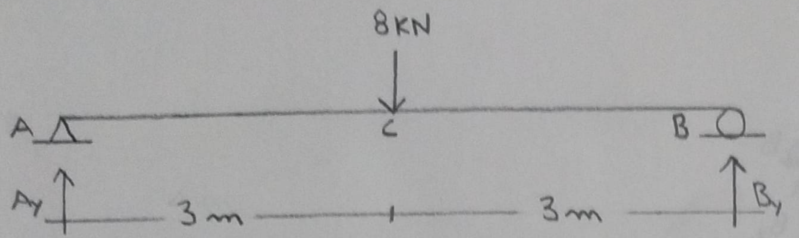
$$EI\,\theta = \frac{-WL^2x}{2} - \frac{Wx^3}{6} + \frac{WLx^2}{2} + C_1 \Rightarrow \underline{\underline{C_1 = 0}}$$

$$\theta = \left(\frac{-WL^2x}{2} - \frac{Wx^3}{6} + \frac{WLx^2}{2}\right)\left(\frac{1}{EI}\right)$$

$$\Delta = \left(\frac{-WL^2x^2}{4} - \frac{Wx^4}{24} + \frac{WLx^3}{6}\right)\left(\frac{1}{EI}\right)$$

VIGA CONJUGADA

DETERMINE θ_A y Δ_C



$\Sigma M_A = 0$

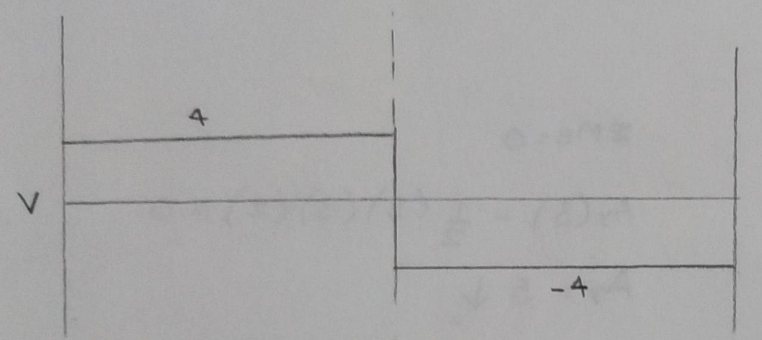
$-3(8) + 6B_y = 0$

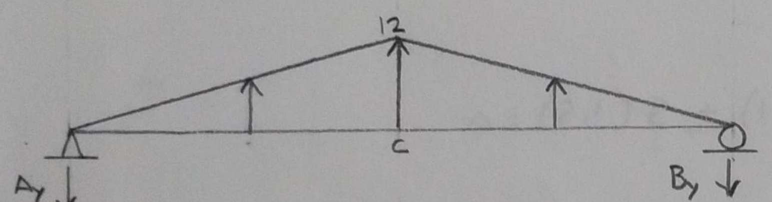
$B_y = 4\ KN \uparrow$

$\Sigma F_y = 0$

$A_y - 8 + 4 = 0$

$A_y = 4\ KN \uparrow$





$\Sigma M_B = 0$

$-\frac{1}{2}(12)(3)(2) - \frac{1}{2}(12)(3)(4) + 6A_y = 0$

$-36 - 72 + 6A_y = 0$

$A_y = 18 \downarrow$

$\Sigma M_c = 0$

$\frac{-1}{2}(12)(3)(1) + 3(18) + M_c = 0$

$M_c - 18 + 54 = 0$

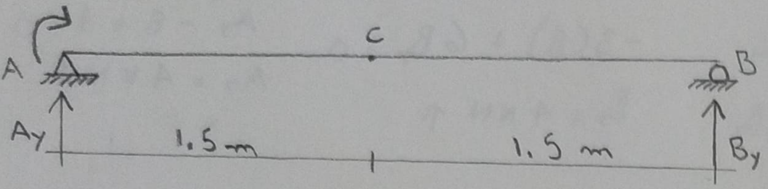
$M_c = -36$

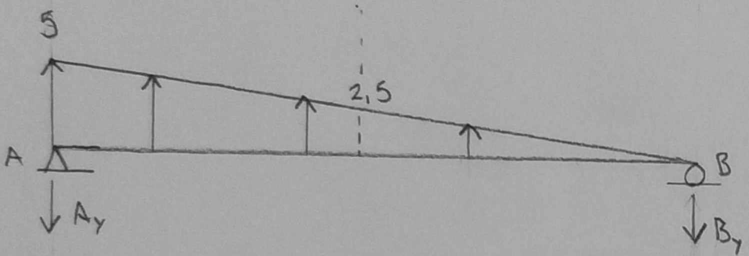
$\theta_A = V_A = \frac{18}{EI}\ KN \cdot m^2$

$\Delta_c = M_c = \frac{36}{EI}\ KN \cdot m^3 \downarrow$

VIGA CONJUGADA

DETERMINE θ_A Y Δ_C





$\Sigma M_B = 0$

$A_y(3) - \frac{1}{2}(5)(3)(2) = 0$

$A_y = 5 \downarrow$

$\Sigma M_C = 0$

$M_C - 2,5(1,5)(0,75) - \frac{1}{2}(2,5)(1,5)(1) + 5(1,5) = 0$

$M_C - 2,8125 - 1,875 + 7,5 = 0$

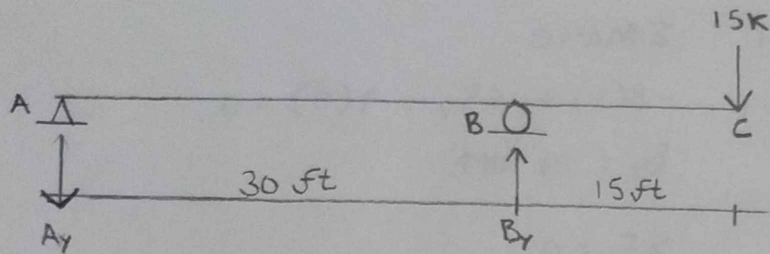
$M_C = 2,8125 \circlearrowleft$

$\theta_A = V_A = \dfrac{5}{EI}\ KN \cdot m^2$

$\Delta_C = M_C = \dfrac{2,8125}{EI}\ KN \cdot m^3 \downarrow$

VIGA CONJUGADA

DETERMINE θ_C Y Δ_C



$\Sigma M_A = 0$

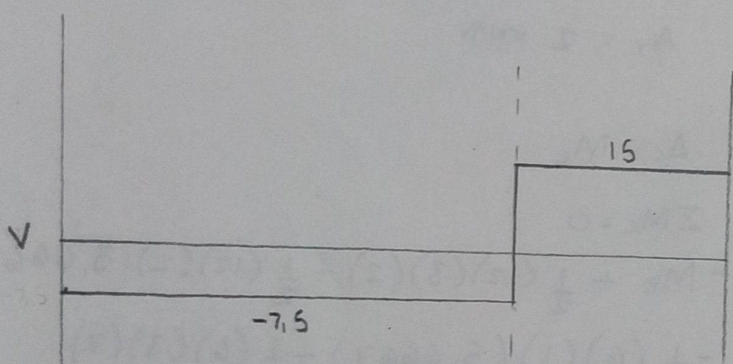
$30 B_y - 45(15) = 0$

$B_y = 22,5 \text{ K} \uparrow$

$\Sigma F_y = 0$

$-A_y + 22,5 - 15 = 0$

$A_y = 7,5 \text{ K} \downarrow$



$\Delta_C = M_C$

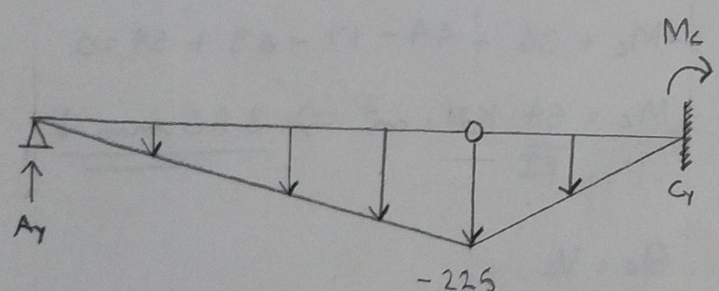
$\circlearrowleft + \Sigma M_C = 0$

$-M_C + \frac{1}{2}(225)(15)(10) +$

$\frac{1}{2}(225)(30)(25) - 1125(45) = 0$

$-M_C + 16875 + 84375 - 50625 = 0$

$M_C = \dfrac{-50625}{EI} \text{ K}\cdot\text{ft}^3 \downarrow$



$\theta_C = V_C$

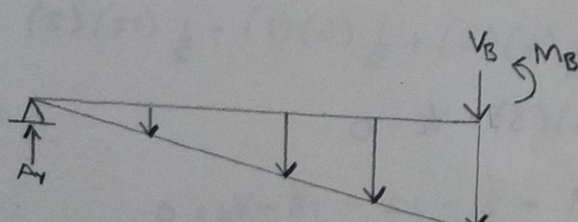
$\Sigma F_y = 0$

$-V_C - \frac{1}{2}(225)(15) - \frac{1}{2}(225)(30)$

$+ 1125 = 0$

$-V_C - 1687,5 - 3375 + 1125 = 0$

$V_C = \dfrac{-3937,5}{EI} \text{ K}\cdot\text{ft}^2$



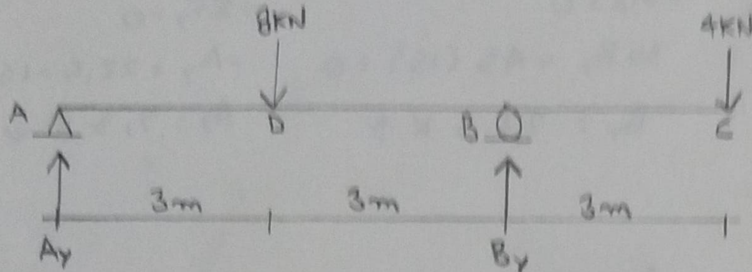
$\Sigma M_B = 0$

$\frac{1}{2}(225)(30)(10) - 30 A_y = 0$

$A_y = 1125 \uparrow$

VIGA CONJUGADA

DETERMINE θ_C Y Δ_C, ($E = 200\ GPa$, $I = 70 \times 10^6\ mm^4$)



$\Sigma M_A = 0$

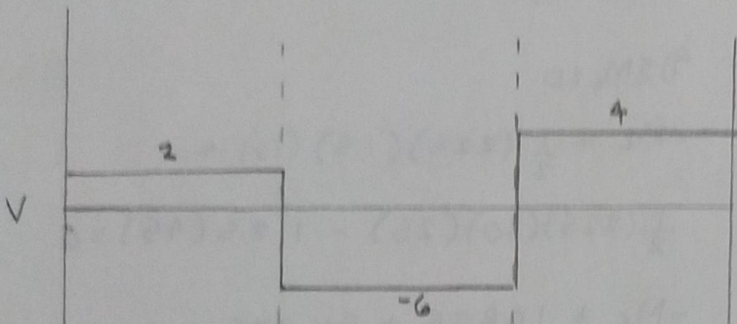
$-8(3) + 6B_y - 9(4) = 0$

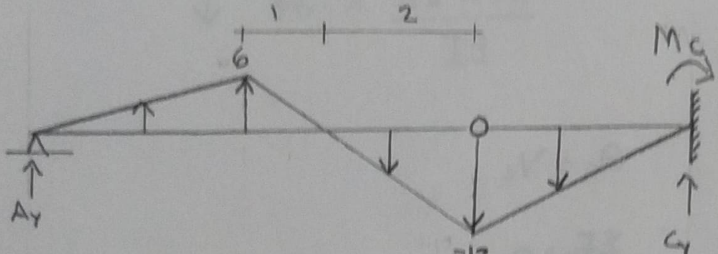
$B_y = 10\ KN \uparrow$

$\Sigma F_y = 0$

$A_y - 8 + 10 - 4 = 0$

$A_y = 2\ KN \uparrow$





$\Delta_C = M_C$

$\Sigma M_C = 0$

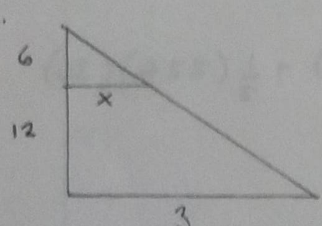
$-M_C + \frac{1}{2}(12)(3)(2) + \frac{1}{2}(12)(2)(3,6667)$

$-\frac{1}{2}(6)(1)(5,6667) - \frac{1}{2}(6)(3)(7)$

$-9(-6) = 0$

$-M_C + 36 + 44 - 17 - 63 + 54 = 0$

$M_C = \frac{54}{EI}\ KN \cdot m^3 \Rightarrow \underline{3,86\ mm \downarrow}$



$\frac{x}{6} = \frac{3}{18}$

$x = 1$

$\theta_C = V_C$

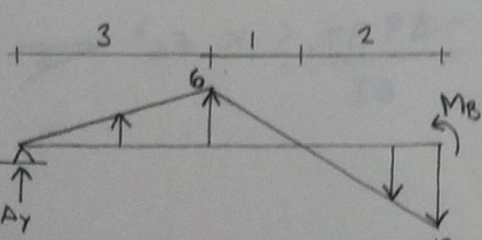
$\Sigma F_y = 0$

$-6 + \frac{1}{2}(6)(3) + \frac{1}{2}(6)(1) - \frac{1}{2}(12)(2)$

$-\frac{1}{2}(12)(3) - V_C = 0$

$-6 + 9 + 3 - 12 - 18 - V_C = 0$

$V_C = \frac{-24}{EI}\ KN \cdot m^2 \Rightarrow \underline{0,001714\ RAD}$



$\Sigma M_B = 0$

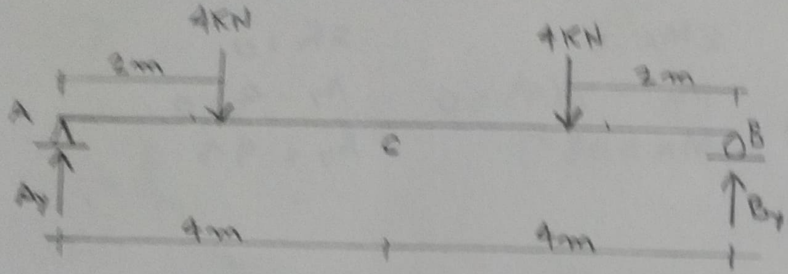
$\frac{1}{2}(12)(2)(0,6667) - \frac{1}{2}(6)(1)(2,6667) - \frac{1}{2}(6)(3)(4) - 6A_y = 0$

$8 - 8 - 36 - 6A_y = 0$

$A_y = -6 \downarrow$

VIGA CONJUGADA

DETERMINE θ_A Y Δ_C



$\Sigma M_A = 0$

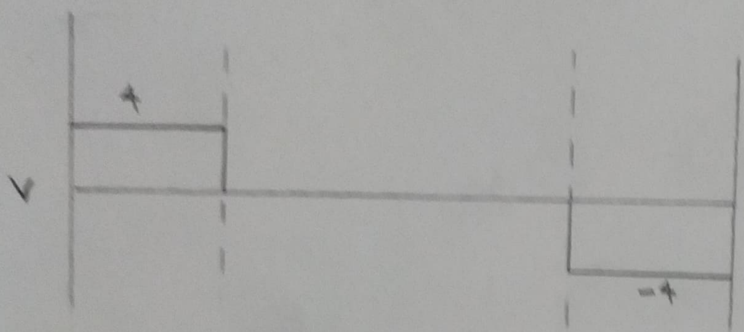
$-2(4) - 6(4) + 8B_y = 0$

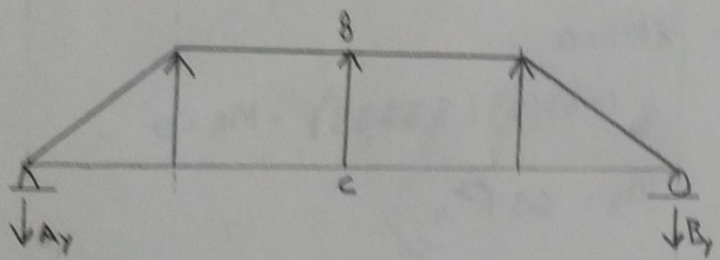
$B_y = 4 \uparrow$

$\Sigma F_y = 0$

$A_y - 4 - 4 + 4 = 0$

$A_y = 4 \uparrow$





$\Sigma M_B = 0$

$-\frac{1}{2}(8)(2)(1{,}3333) - 8(4)(4)$

$-\frac{1}{2}(8)(2)(6{,}6667) + 8A_y = 0$

$-10{,}6664 - 128 - 53{,}3334 + 8A_y = 0$

$A_y = 24 \downarrow$

$\Sigma M_C = 0$

$-8(2)(1) - \frac{1}{2}(8)(2)(2.6667) + 4(24) + M_C = 0$

$M_C - 16 - 21{,}3336 + 96 = 0$

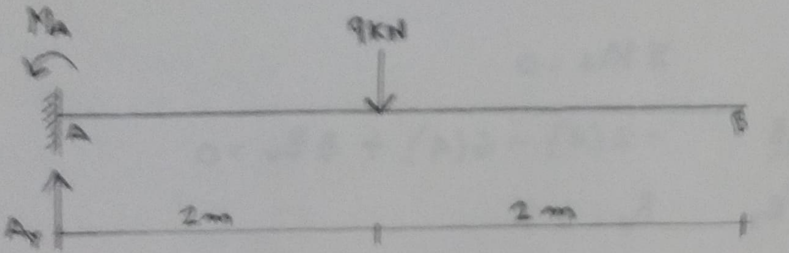
$M_C = -58{,}7$ ↱

$\theta_A = V_A = \dfrac{24}{EI}\ KN \cdot m^2$

$\Delta_C = M_C = \dfrac{58{,}7}{EI}\ KN \cdot m^3 \downarrow$

Viga Conjugada

Determine θ_B y Δ_B



$\Sigma M_A = 0$

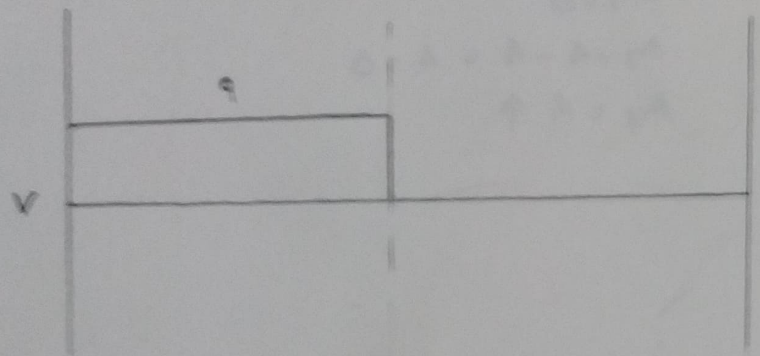
$M_A - 2(9) = 0$

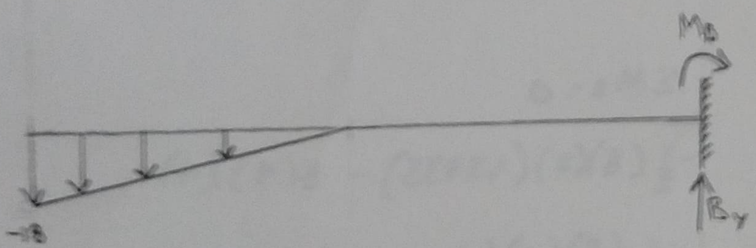
$M_A = 18 \circlearrowleft$

$\Sigma F_y = 0$

$A_y - 9 = 0$

$A_y = 9 \uparrow$





$\Sigma M_B = 0$

$\frac{1}{2}(18)(2)(3{,}3333) - M_B = 0$

$M_B = 60 \circlearrowright$

$\Sigma F_y = 0$

$-\frac{1}{2}(18)(2) + B_y = 0$

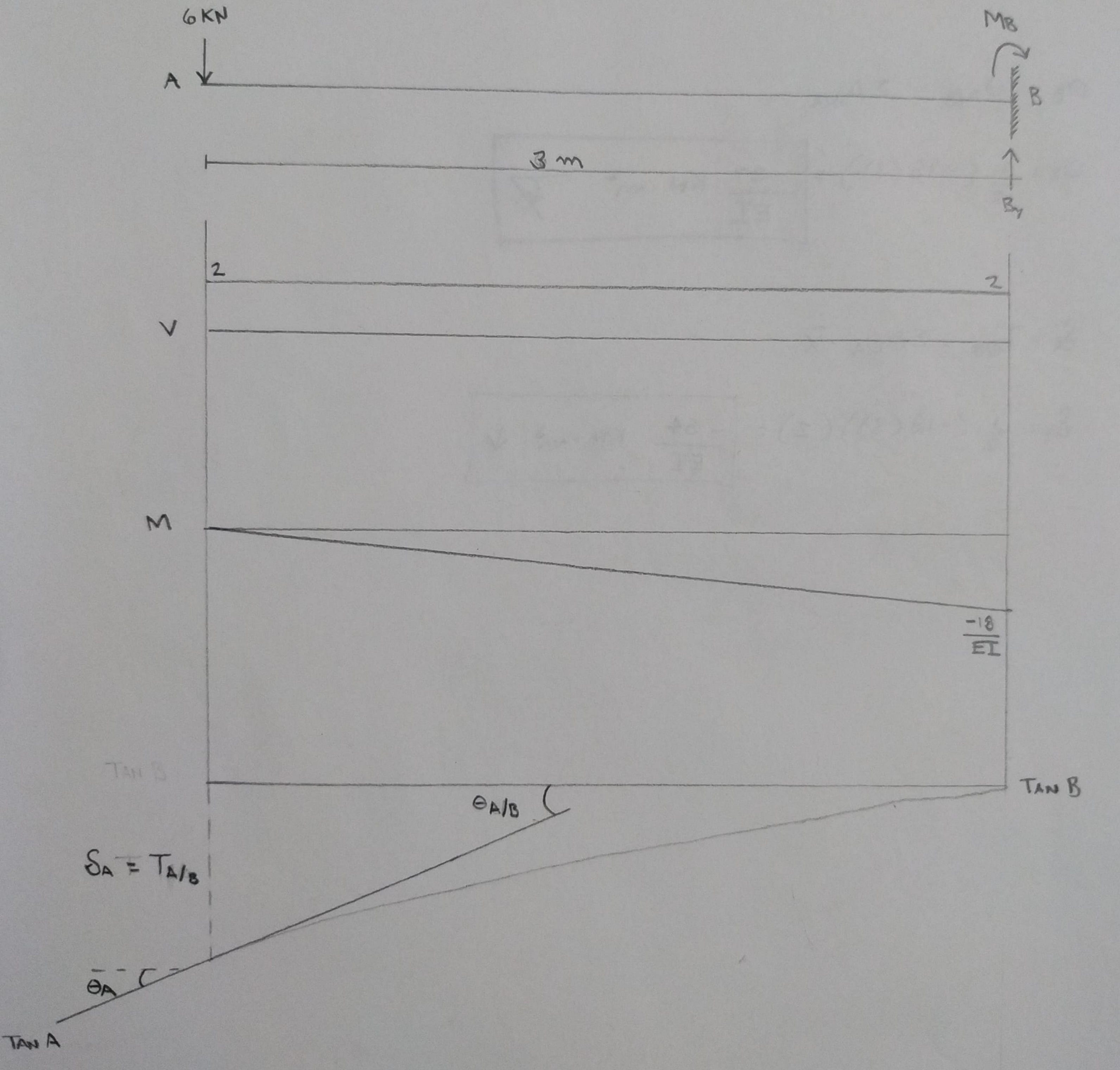
$B_y = 18 \uparrow$

$\theta_B = V_B = \frac{18}{EI}\ KN \cdot m^2$

$\Delta_B = M_B = \frac{60}{EI}\ KN \cdot m^3 \downarrow$

AREA MOMENTO

DETERMINE LA PENDIENTE Y LA DEFLEXION EN A . EI = CONSTANTE



REACIONES

$\Sigma F_y = 0$

$-6 + B_y = 0$

$B_y = 6 \text{ KN} \uparrow$

$\Sigma M_B = 0$

$-M_B + 6(3) = 0$

$M_B = 18 \text{ KN}$

$\theta_B = \theta_{A/B} = \Sigma A_{B/A}$

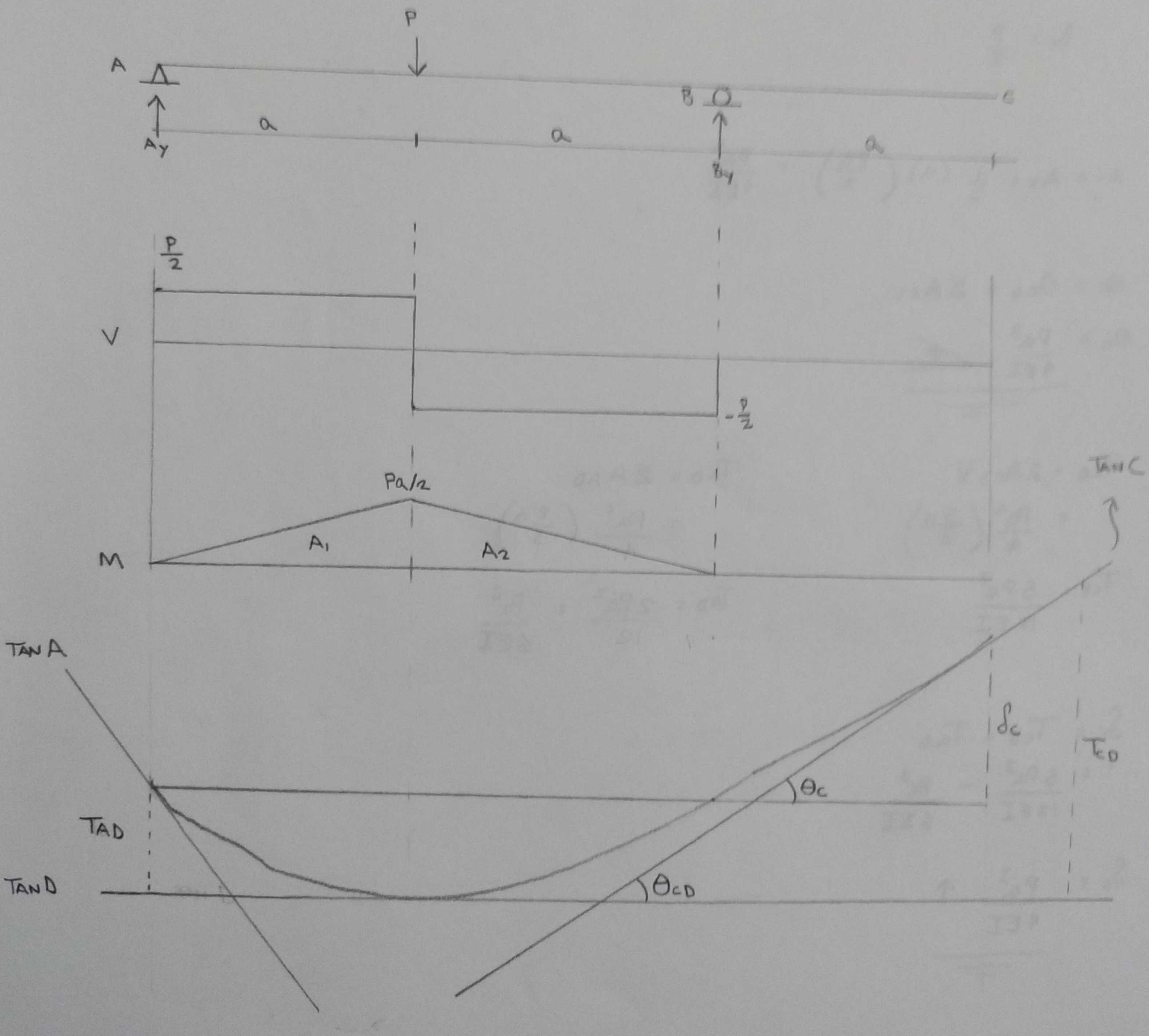
$\theta_B = \frac{1}{2}(-18(3)) = \boxed{\frac{-27}{EI} \text{ KN}\cdot m^2}$

$\delta_A = T_{A/B} = \Sigma A_{B/A} \cdot \tilde{X}$

$\delta_A = \frac{1}{2}(-18(3))(2) = \boxed{\frac{-54}{EI} \text{ KN}\cdot m^3 \downarrow}$

AREA MOMENTO

DETERMINE LA PENDIENTE Y EL DESPLAZAMIENTO EN C.
EI = CONSTANTE.



REACCIONES

$\circlearrowleft \Sigma M_A = 0$

$-aP + 2a\,B_y = 0$

$B_y = \frac{aP}{2a}$

$B_y = \frac{P}{2}$

$\Sigma F_y = 0$

$A_y - P + \frac{P}{2}$

$A_y = \frac{P}{2}$

$A_1 = A_2 = \frac{1}{2}(a)\left(\frac{Pa}{2}\right) = \frac{Pa^2}{4EI}$

$\theta_c = \theta_{CD} = \Sigma A_{CD}$

$\theta_c = \frac{Pa^2}{4EI}$

$T_{CD} = \Sigma A_{CD}\overline{X}$

$= \frac{Pa^2}{4}\left(\frac{5}{3}a\right)$

$T_{CD} = \frac{5Pa^3}{12EI}$

$T_{AD} = \Sigma A_{AD}$

$= \frac{Pa^2}{4}\left(\frac{2}{3}a\right)$

$T_{AD} = \frac{2Pa^2}{12} = \frac{Pa^3}{6EI}$

$\delta_c = T_{CD} - T_{AD}$

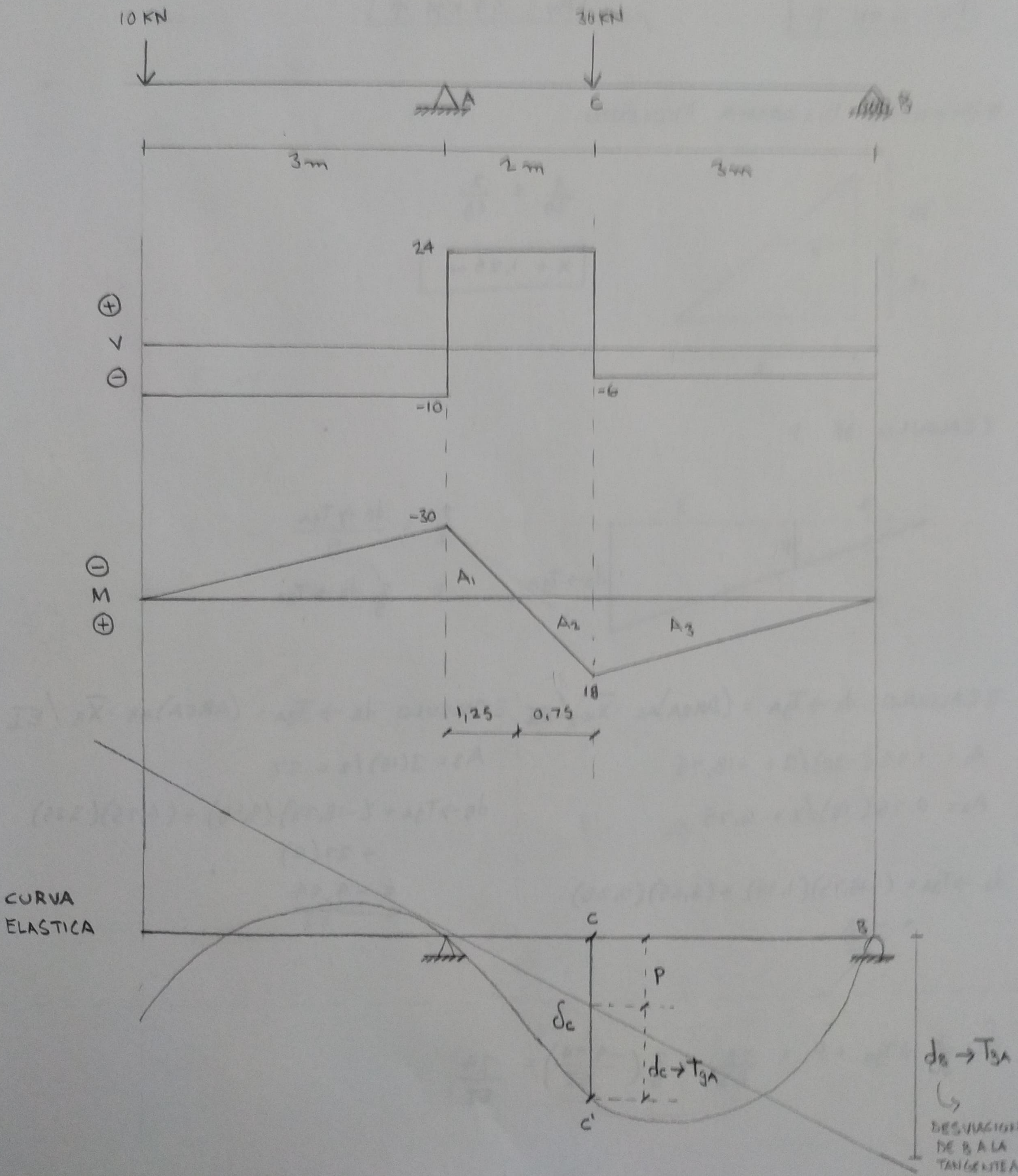
$= \frac{5Pa^3}{12EI} - \frac{Pa^3}{6EI}$

$\delta_c = \frac{Pa^3}{4EI} \uparrow$

AREA MOMENTO

CALCULAR LA DEFLEXIÓN EN EL PUNTO C

EI = CONSTANTE



≡ REACIONES

① $\Sigma M_A = 0$

$10(3) - 30(2) + 5B_y = 0$

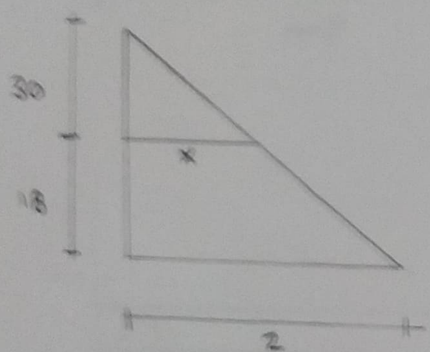
$\boxed{B_y = 6\ KN\ \uparrow}$

$\Sigma F_y = 0$

$-10 - 30 + 6 + A_y = 0$

$\boxed{A_y = 34\ KN\ \uparrow}$

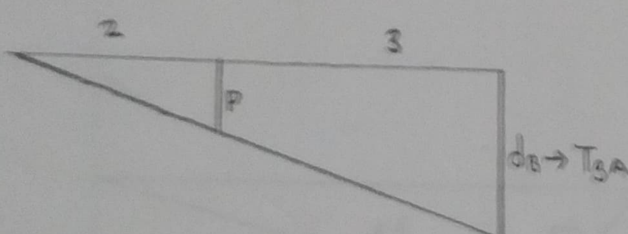
≡ DISTANCIAS DIAGRAMA MOMENTO



$\frac{x}{30} = \frac{2}{48}$

$\boxed{x = 1{,}25\ m}$

≡ CALCULO DE P



$\frac{P}{2} = \frac{d_B \to T_{BA}}{5}$

$P = \frac{2}{5}\, d_B \to T_{BA}$

≡ CALCULO $d_c \to T_{gA} = (AREA)_{AC} \cdot \bar{X}_c / EI$

$A_1 = 1{,}25(-30)/2 = -18{,}75$

$A_2 = 0{,}75(18)/2 = 6{,}75$

$d_c \to T_{gA} = (-18{,}75)(1{,}58) + (6{,}25)(0{,}25)$

$= \frac{-28}{EI}$

≡ CALCULO $d_B \to T_{gA} = (AREA)_{AB} \cdot \bar{X}_B / EI$

$A_3 = 3(18)/2 = 27$

$d_B \to T_{gA} = (-18{,}75)(4{,}58) + (6{,}75)(3{,}25)$

$+ 27(2)$

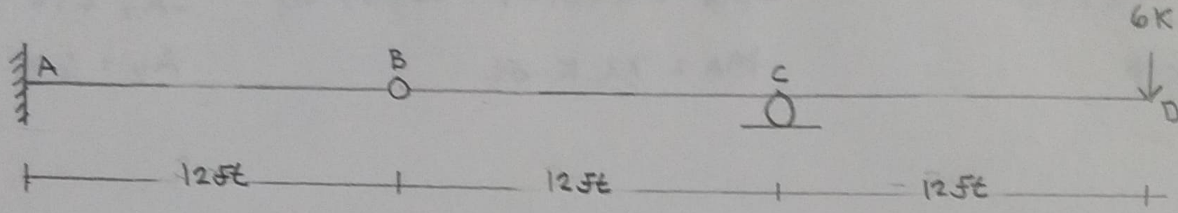
$= \frac{-9{,}94}{EI}$

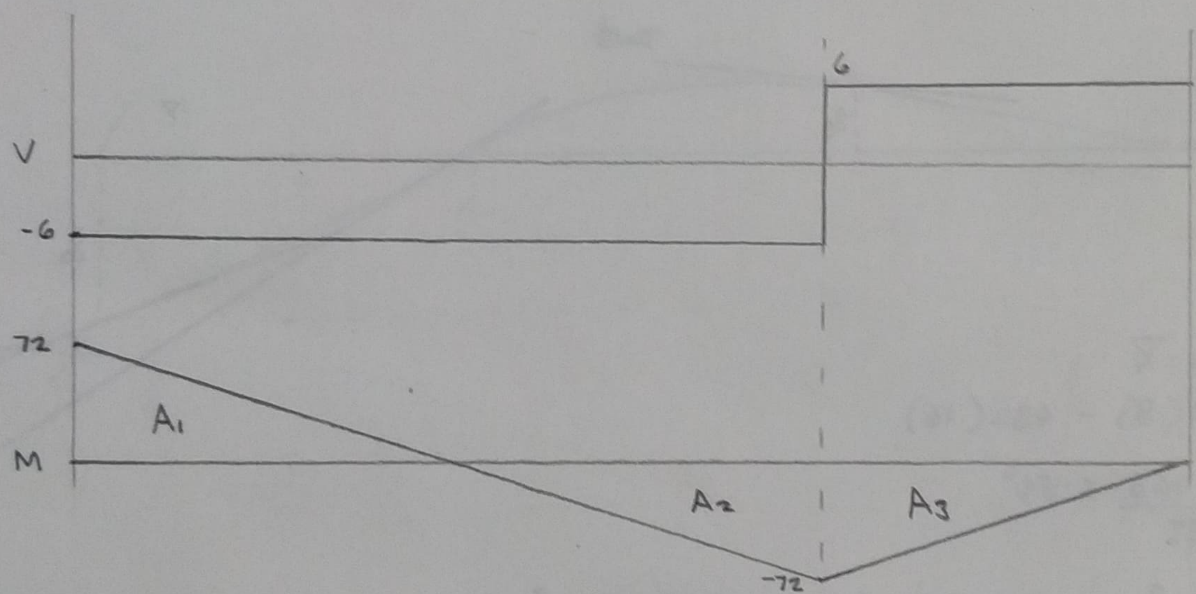
$\delta_c = d_c \to T_{gA} + P = \frac{28}{EI} + \frac{2}{5}\left(\frac{-9{,}94}{EI}\right) = \frac{24}{EI}$

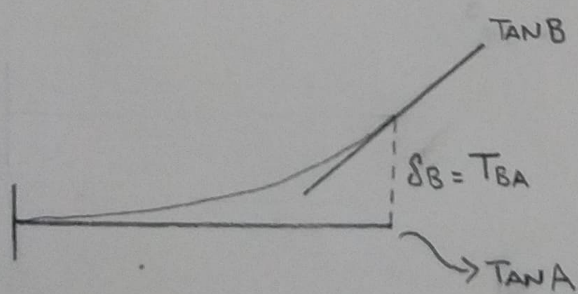
AREA MOMENTO

X

DETERMINE LA PENDIENTE Y EL DESPLAZAMIENTO EN D. SUPONGA QUE A ES UN SOPORTE FIJO, B ES ARTICULACIÓN Y D UN RODILLO. EI ES CONSTANTE.







$$\delta_B = T_{BA} = \Sigma A_{BA} \cdot \bar{X}$$

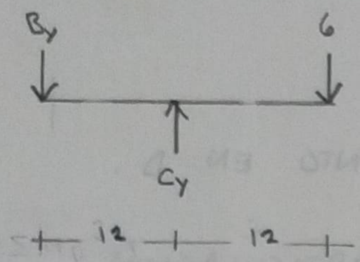
$$= 432\,(8)$$

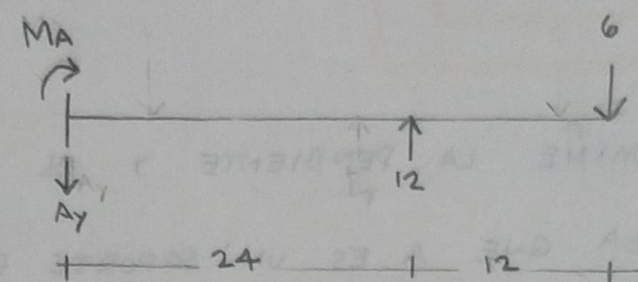
$$\delta_B = \frac{3456}{EI}\ K \cdot ft^3 \uparrow$$

$$A_1 = \frac{1}{2}(12)(72) = \frac{432}{EI}\ K \cdot ft^2$$

$$A_3 = A_2 = \frac{-432}{EI}\ K \cdot ft^2$$

REACIONES





$\circlearrowleft + \Sigma M_B = 0$

$12 C_y - 24(6) = 0$

$C_y = 12\ K \uparrow$

$\circlearrowleft + \Sigma M_A = 0$

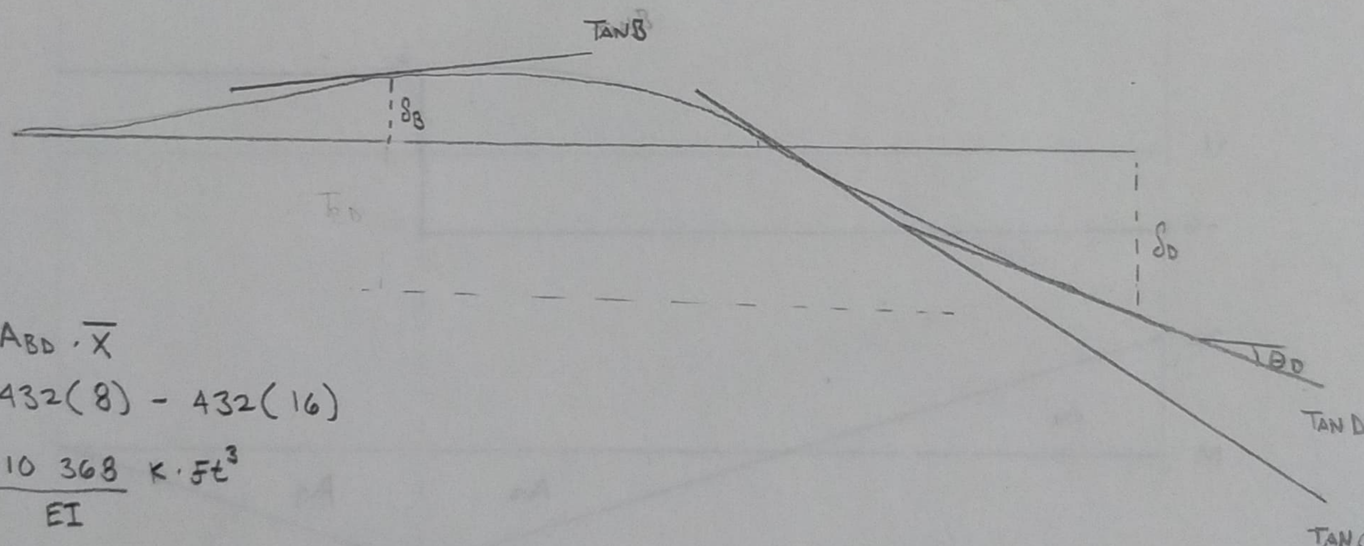
$-M_A + 24(12) - 36(6) = 0$

$M_A = 72\ K \cdot ft$

$\Sigma F_y = 0$

$-A_y + 12 - 6 = 0$

$A_y = 6\ K \downarrow$



$T_{BD} = \Sigma A_{BD} \cdot \overline{X}$

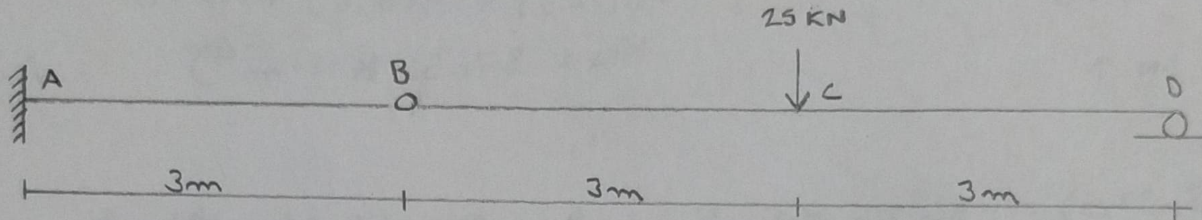
$= -432(8) - 432(16)$

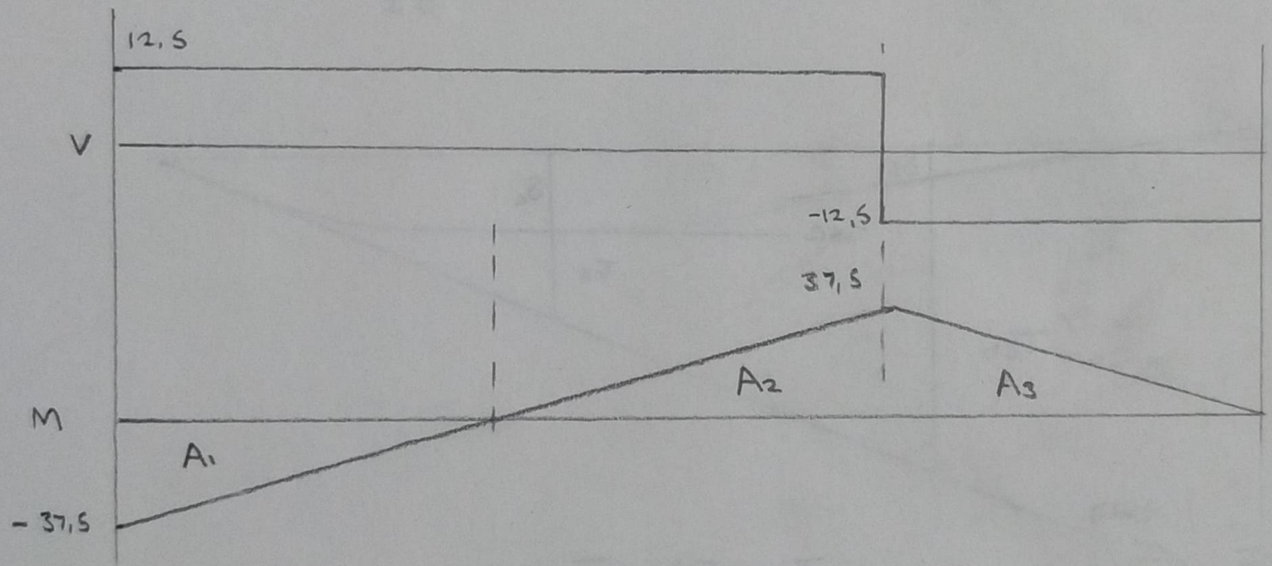
$T_{BD} = \dfrac{-10\,368}{EI}\ K \cdot ft^3$

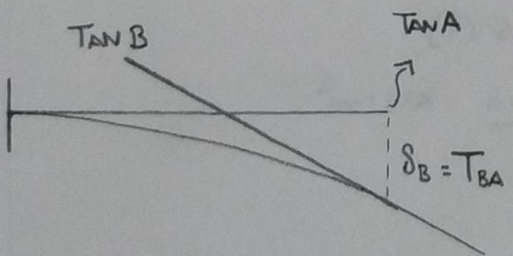
$\delta_D = T_{BD} - \delta_B = 10\,368 - 3456 = \dfrac{6912}{EI}\ K \cdot ft^3$

AREA MOMENTO

DETERMINE EL DESPLAZAMIENTO EN C. A ES UN SOPORTE FIJO Y B UNA ARTICULACIÓN Y D UN RODILLO. EI ES CONSTANTE.







$$T_{BA} = \Sigma A_{BA} \cdot \overline{X}$$

$$= 56.25(2)$$

$$T_{BA} = \frac{112,5}{EI} \ KN \cdot m^3$$