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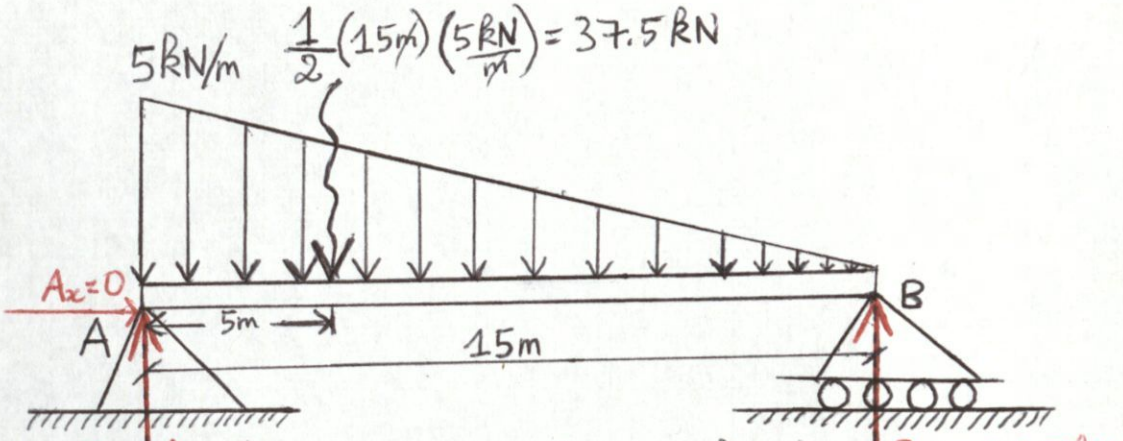
Date: 10th October 2018



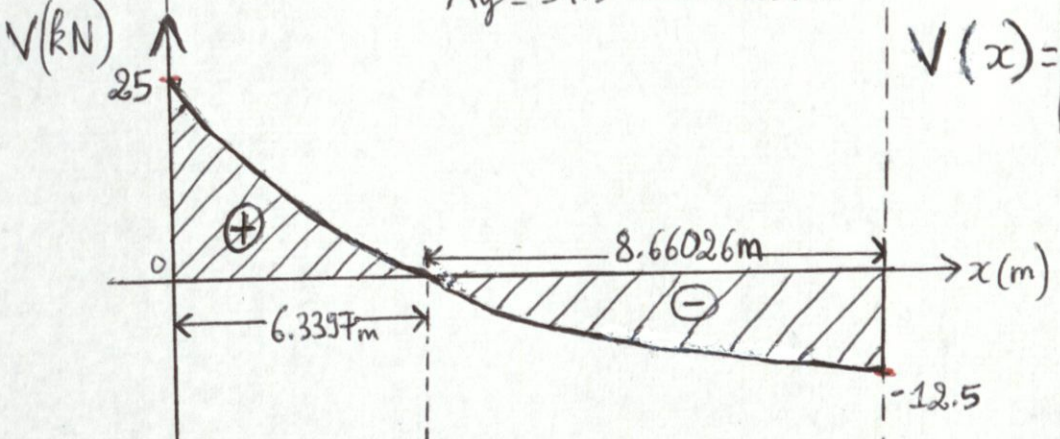
$25kN = A_y$ $+\circlearrowleft \sum M_A = 0 ; (-37.5kN)(5m)+(B_y)(15m)=0$ $B_y = 12.5kN$

$B_y = 12.5kN$

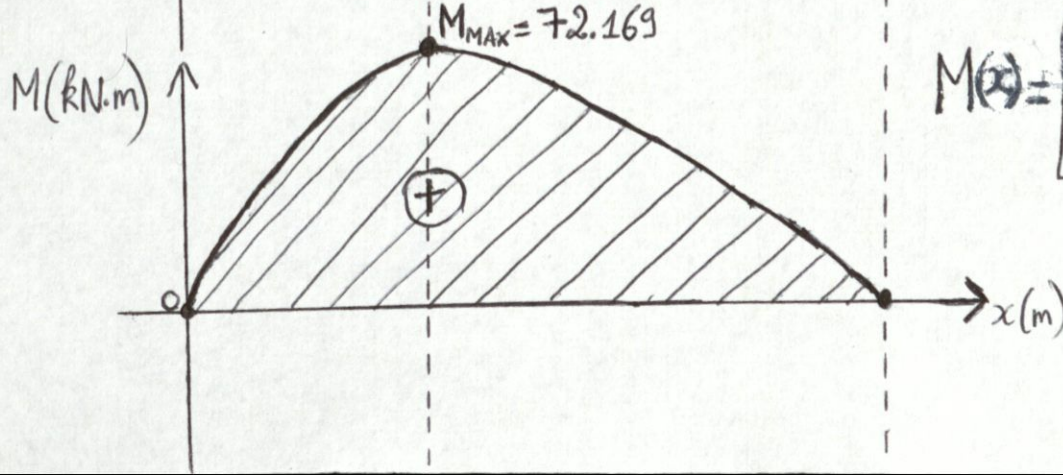
$\pm\rightarrow \sum F_x = 0 ;\ A_x = 0$

$+\uparrow \sum F_y = 0 ;\ A_y + B_y = 37.5kN$

$A_y = 37.5 - 12.5 = 25kN$



$$V(x)=\left[\frac{(15-x)^2}{6}-12.5\right]kN$$



$$M(x)=\left[\frac{-(15-x)^3}{18}+12.5(15-x)\right]kN\text{-}m$$

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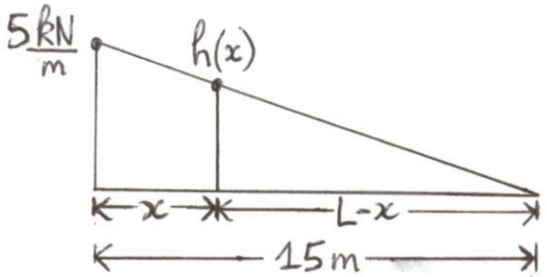
Using Similar Triangles, find h(x)

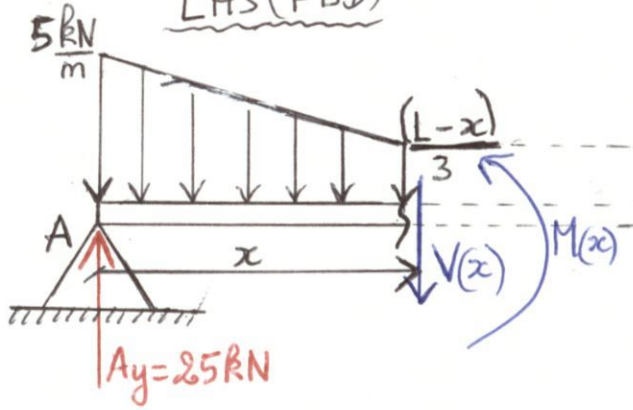


$$\frac{5\,kN/m}{15m} = \frac{h(x)}{(L-x)}$$

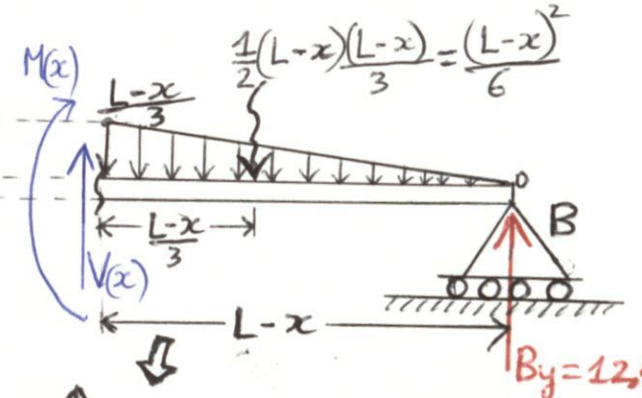
$$h(x) = \frac{(L-x)}{3}$$

Cut the beam to find the equation of V & M

LHS(FBD)



RHS(FBD)



$$+\uparrow \sum F_y = 0$$

$$V(x) + 12.5 = \frac{(L-x)^2}{6}$$

$$V(x) = \left[\frac{(L-x)^2}{6} - 12.5\right] kN \xleftarrow{L=15m} V(x) = \left[\frac{(15-x)^2}{6} - 12.5\right] kN$$

$$+\circlearrowleft \sum M_x = 0$$

$$-M(x) + \left[-\frac{(L-x)^2}{6}\right]\left(\frac{L-x}{3}\right) + (12.5)(L-x) = 0$$

$$M(x) = \left[-\frac{(L-x)^3}{18} + 12.5L - 12.5x\right] kN\cdot m$$

$L=15m$

$$M(x) = \left[-\frac{(15-x)^3}{18} + 12.5(15-x)\right] kN\cdot m$$

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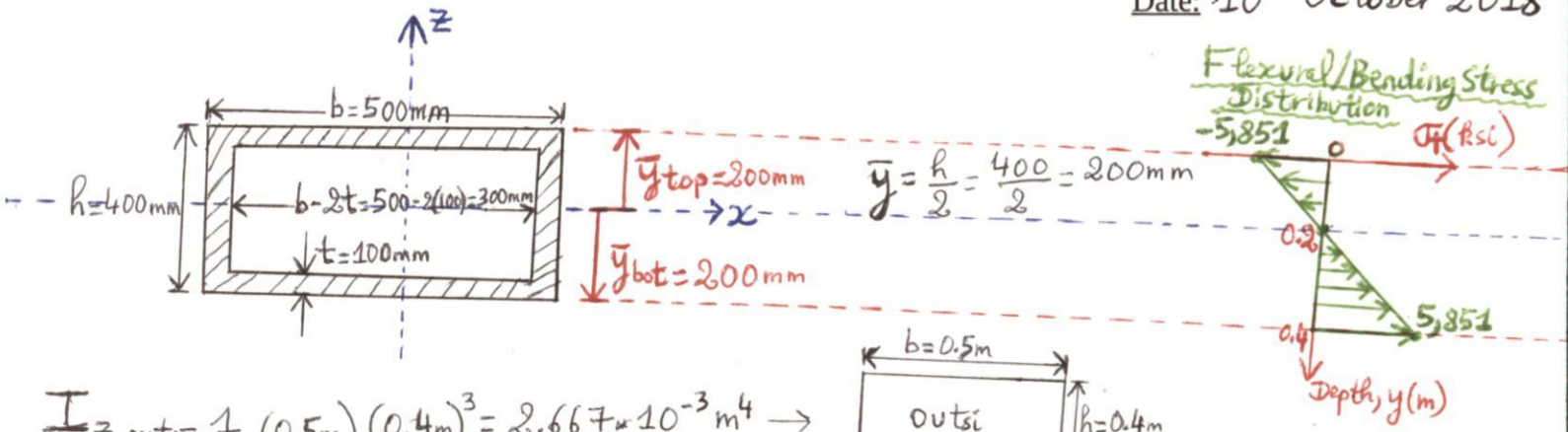
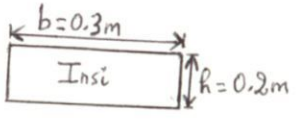


$$I_{z,outsi} = \frac{1}{12}(0.5m)(0.4m)^3 = 2.667 * 10^{-3} m^4 \rightarrow$$

$$I_{z,insi} = \frac{1}{12}(0.3m)(0.2m)^3 = 2 * 10^{-4} m^4 \rightarrow$$



$$I_{z,Tot} = I_{z,outsi} - I_{z,insi} = (2.667 * 10^{-3} m^4) - (2 * 10^{-4} m^4) = 2.467 * 10^{-3} m^4$$

$$M_{MAX}\,(\text{from Moment Diagram}) = 72.169\ kN\text{-}m$$

$$\sigma_{MAX,C} = -\frac{M y_{top}}{I_{z,Tot}} = -\frac{(72.169\ kN\text{-}m)(0.2m)}{(2.467 * 10^{-3} m^4)} = -5,850.749899\ ksi = -5,851\ ksi$$

$$\sigma_{MAX,T} = -\frac{M y_{bot}}{I_{z,Tot}} = -\frac{(72.169\ kN\text{-}m)(-0.2m)}{(2.467 * 10^{-3} m^4)} = 5,850.749899\ ksi = 5,851\ ksi$$