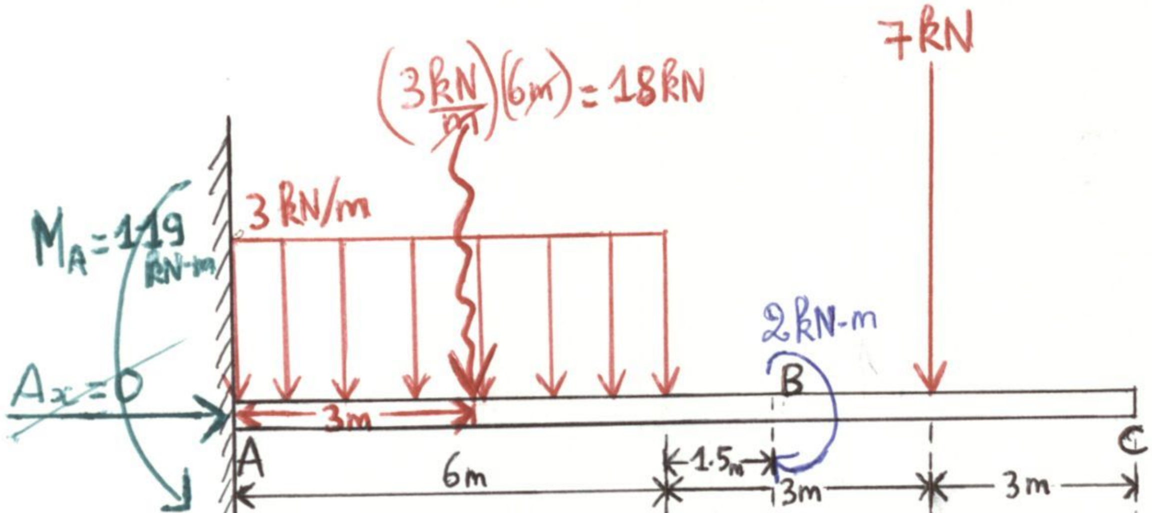
DTY Tutoring, inc.
Email: dtytutoring@gmail.com
Website:www.dtytutoring.com

Date: 23rd October 2018

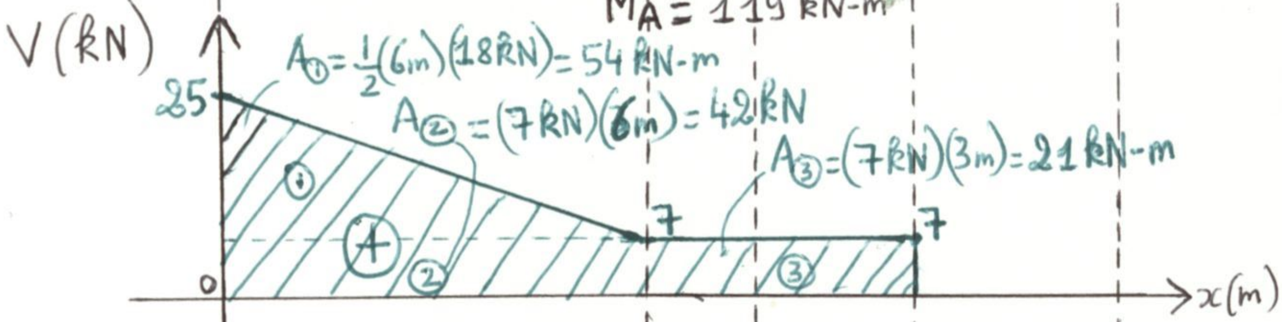


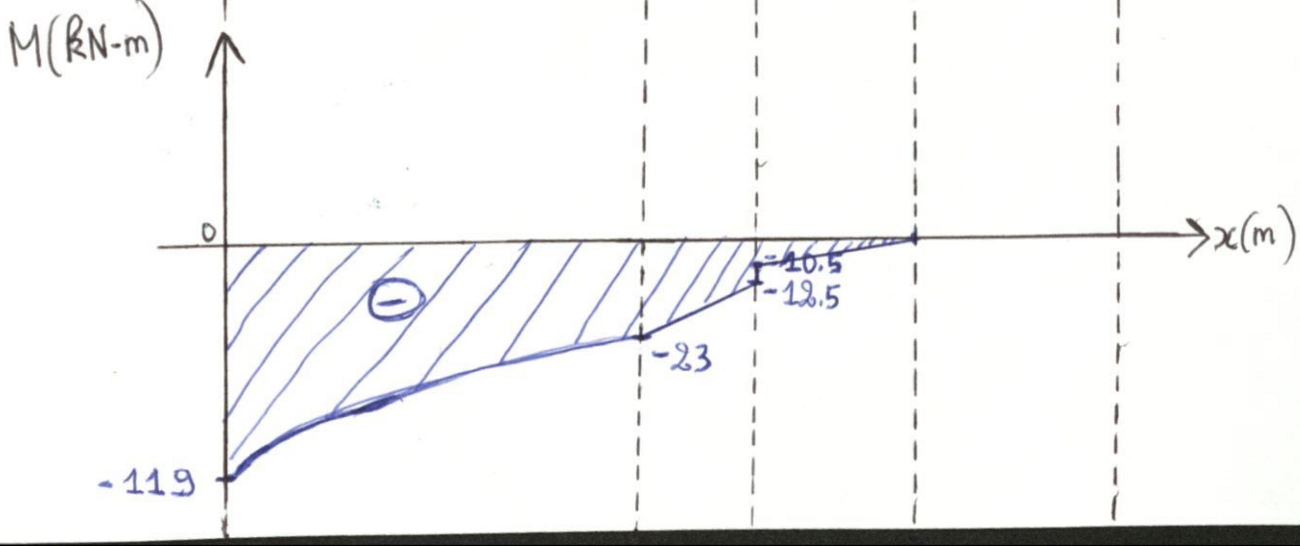

$$+\uparrow\sum F_y = 0;\quad A_y = 18 + 7 = 25\,kN$$

$A_y = 25\,kN$

$$+\circlearrowleft\sum M_A = 0;\quad (-18)(3) + (-2\,kN\text{-}m) + (-7)(9) + M_A = 0$$

$$M_A = 119\,kN\text{-}m$$



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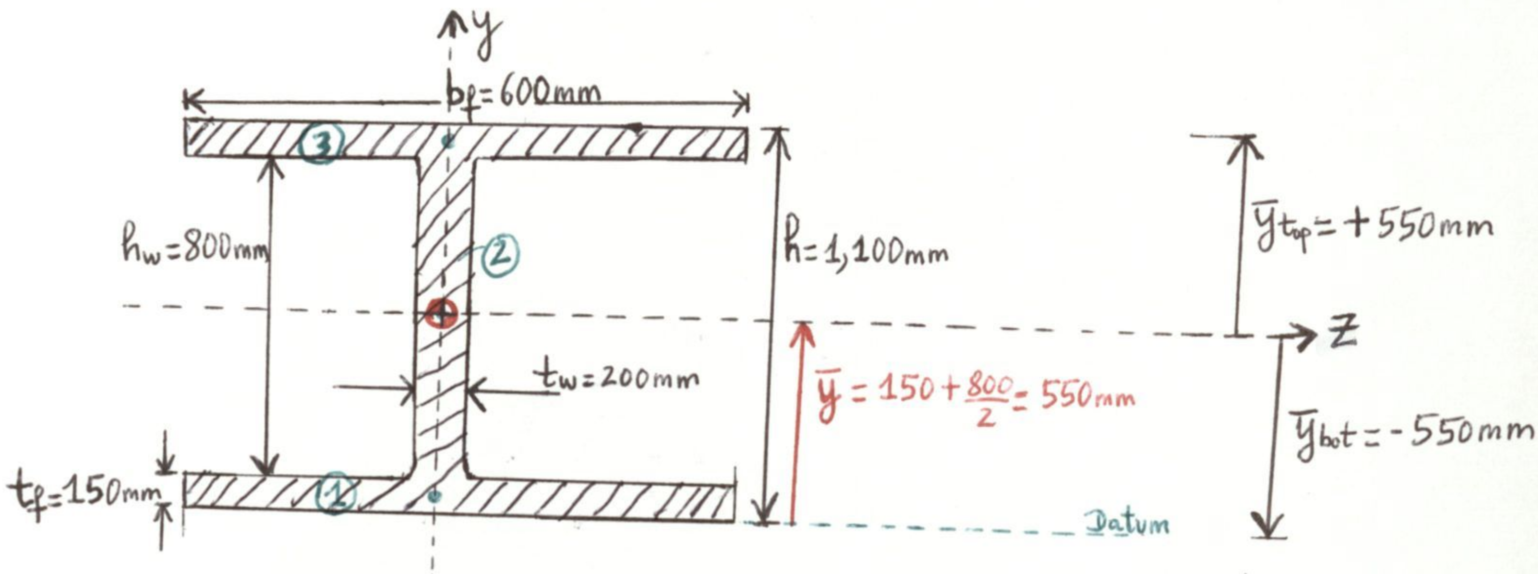


| Section | b | h | $\tilde{y}$ | $A = bh$ | $\tilde{y}A$ | $d = \lvert\tilde{y} - \bar{y}\rvert$ |
|---|---|---|---|---|---|---|
| 1 | 600mm | 150mm | $\frac{150}{2} = 75mm$ | $(600)(150) = 90,000\ mm^2$ | $(75)(90,000) = 6.75 \times 10^6\ mm^3$ | $550 - 75 = 475mm$ |
| 2 | 200mm | 800mm | $150 + \frac{800}{2} = 550mm$ | $(200)(800) = 160,000\ mm^2$ | $(550)(160,000) = 88 \times 10^6\ mm^3$ | $550 - 550 = 0mm$ |
| 3 | 600mm | 150mm | $150 + 800 + \frac{150}{2} = 1,025\ mm$ | $(600)(150) = 90,000\ mm^2$ | $(1,025)(90,000) = 92.25 \times 10^6$ | $1,025 - 550 = 475mm$ |
| | | | | $\Sigma A = 340,000\ mm^2$ | $\Sigma\tilde{y}A = 187 \times 10^6\ mm^3$ | |

$$\bar{y} = \frac{\Sigma\tilde{y}A}{\Sigma A} = \frac{187 \times 10^6\ mm^3}{340,000\ mm^2} = 550\ mm$$

$$I_{1} = \frac{bh^3}{12} + Ad^2 = \frac{(600)(150)^3}{12} + (90,000)(475)^2 = 2.0475 \times 10^{10}\ mm^4$$

$$I_{2} = \frac{bh^3}{12} + Ad^2 = \frac{(200)(800)^3}{12} + \cancel{(160,000)(0)^2} = 85.33 \times 10^8\ mm^4$$

$$I_{3} = I_{1} = 2.0475 \times 10^{10}\ mm^4$$

$$I_{z}(tot) = I_{1} + I_{2} + I_{3} = 4.948333 \times 10^{10}\ \cancel{mm^4}\left(\frac{1 \times 10^{-12}\ m^4}{1\ \cancel{mm^4}}\right) = 4.9483 \times 10^{-2}\ m^4$$

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$M_{MAX} = -119\ kN\text{-}m$

$I_z = 4.9483 \times 10^{-2}\ m^4$

$\bar{y}_{bot} = -550mm = -0.55m$

$\bar{y}_{top} = 550\ mm = 0.55m$

$$\sigma_{x(T)} = \frac{-(M_{MAX})(\bar{y}_{top})}{I_z}$$

$$= -\frac{(-119\ kN\text{-}m)(\overset{\bar{y}_{top}}{0.55m})}{(4.9483 \times 10^{-2}\ m^4)}$$

$$\boxed{\sigma_{x_{MAX}(T)} = 1{,}323\ kPa = 1.32\ MPa}$$ → Maximum flexural tensile stress (+)

$$\sigma_{x(c)} = \frac{-(M_{MAX})(\bar{y}_{bot})}{I}$$

$$= -\frac{(-119\ kN\text{-}m)(-0.55m)}{(4.9483 \times 10^{-2}\ m^4)}$$

$$\boxed{\sigma_{x_{MAX}(c)} = -1{,}323\ kPa = 1.32\ MPa}$$ → Maximum flexural compressive stress (−)