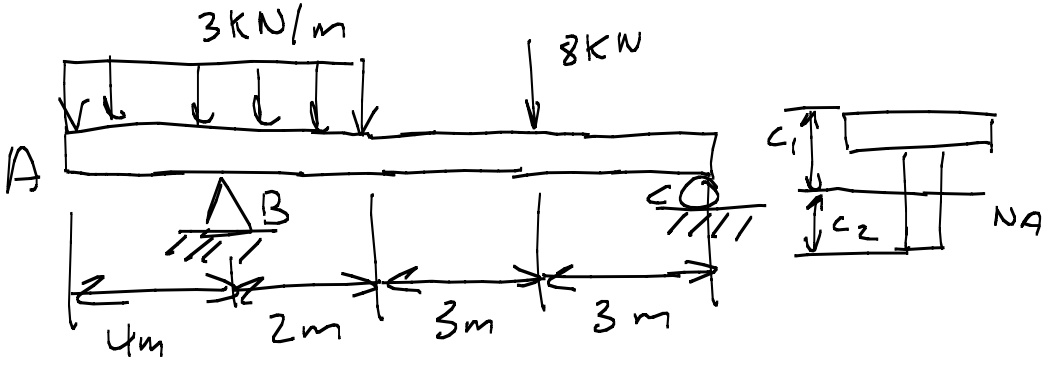
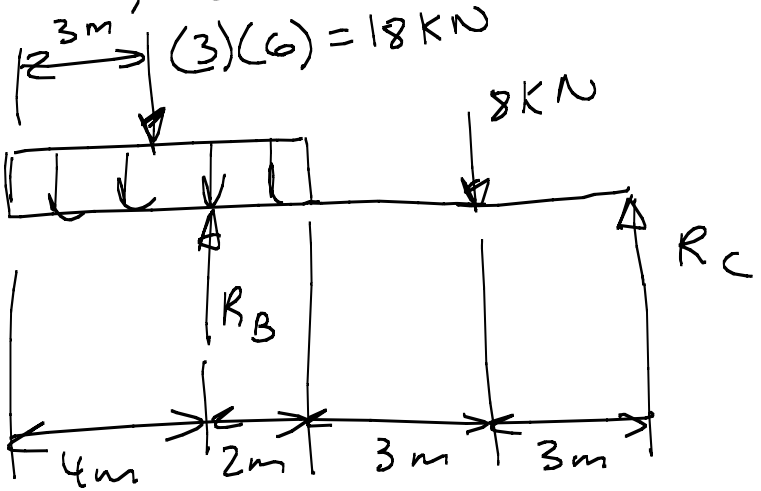
Determine

- Shear and Bending Moment Diagrams
- Maximum Compressive and Tensile Bending Stresses



if $I = 7.931 \times 10^{-5} m^4$, $c_1 = 76.79mm$, $c_2 = 223.2mm$



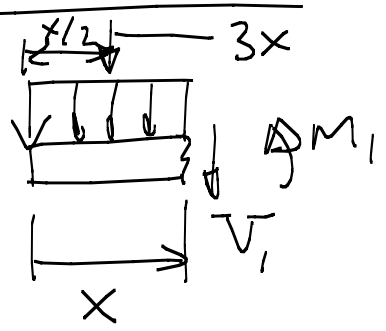
$$+\uparrow \sum F_y = 0 \Rightarrow -18KN + R_B - 8KN + R_C = 0$$

$$\boxed{R_B + R_C = 26}$$

$$+\circlearrowleft \sum M_C = 0 \Rightarrow (8KN)(3m) + (18KN)(9m) - R_B(8m) = 0$$

$$\boxed{R_B = 23.25\ KN,\ R_C = 2.75KN}$$

$0 < x < 4m$



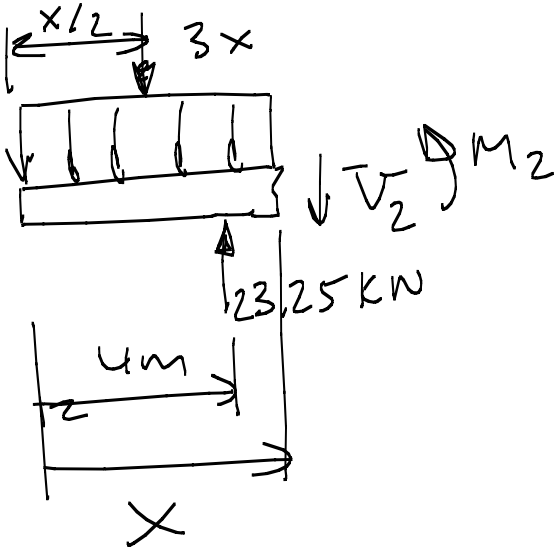
$+\uparrow \sum F_y = 0 \Rightarrow -3x - V_1 = 0$

$$V_1 = -3x$$

$+\circlearrowleft M_{cut} = 0 \Rightarrow M_1 + (3x)\left(\frac{x}{2}\right) = 0$

$$M_1 = -1.5x^2$$

$4 < x < 6m$



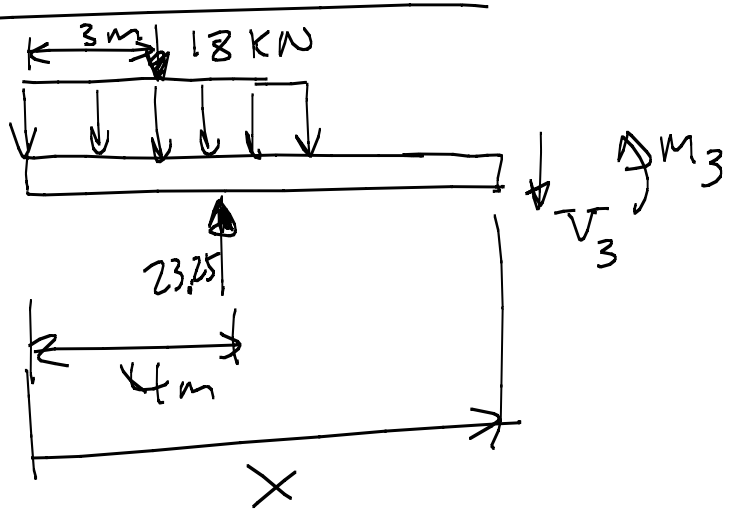
$+\uparrow \sum F_y = 0 \Rightarrow -V_2 + 23.25 - 3x = 0$

$$V_2 = -3x + 23.25$$

$+\circlearrowleft \sum M_{cut} = 0 \Rightarrow M_2 - (23.25)(x-4) + (3x)\left(\frac{x}{2}\right)$

$$M_2 = -1.5x^2 + 23.25x - 93$$

$6m < x < 9m$



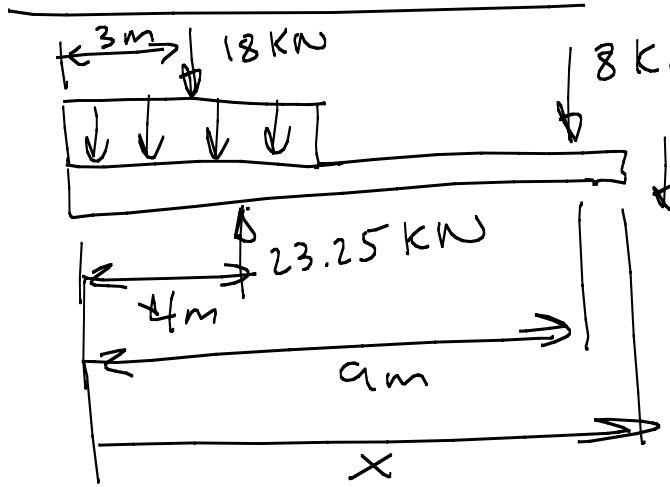
$$+\uparrow \Sigma F_y = 0 \Rightarrow -V_3 + 23.25 - 18 = 0$$

$$\boxed{V_3 = 5.25 \text{ KN}}$$

$$+\circlearrowleft \Sigma M_{cut} = 0 \Rightarrow M_3 - (23.25)(x-4) + (18)(x-3) = 0$$

$$\boxed{M_3 = 5.25x - 39}$$

$9m < x < 12m$



$$+\uparrow \Sigma F_y = 0 \Rightarrow -V_4 - 8\text{ KN} + 23.25 - 18\text{ KN} = 0$$

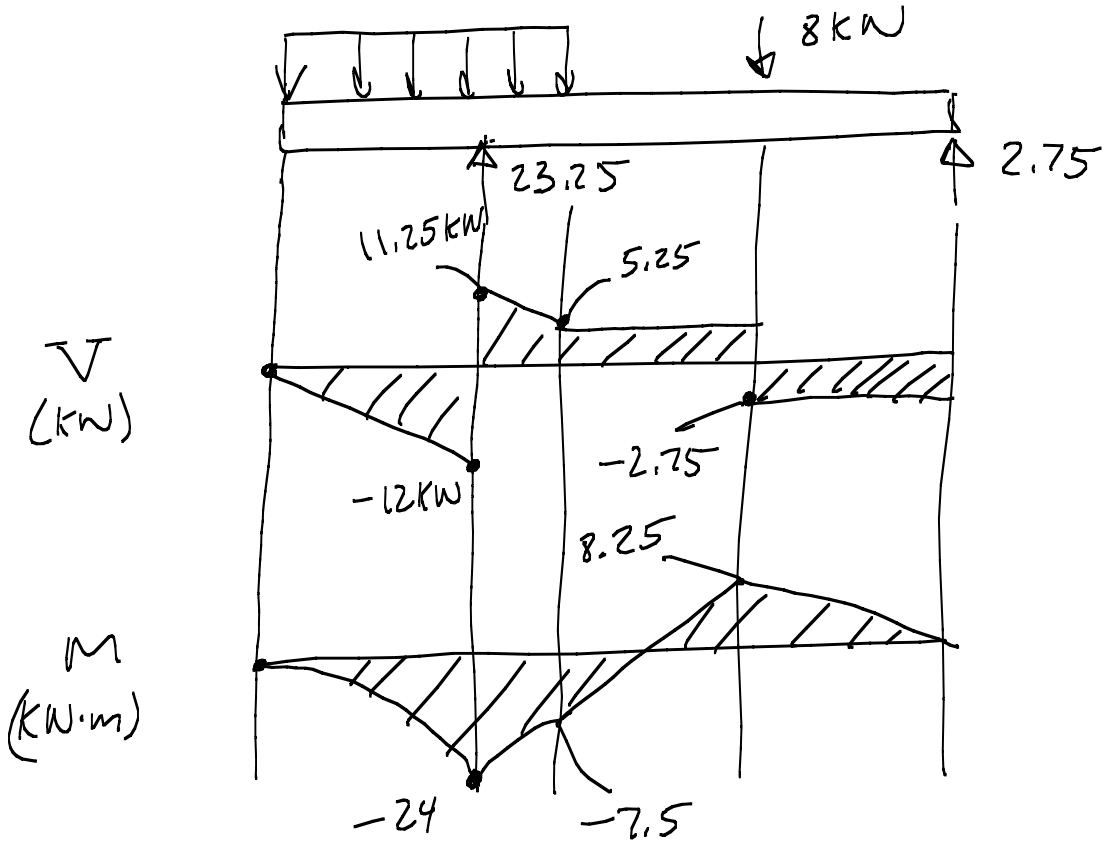
$$\boxed{V_4 = -2.75 \text{ KN}}$$

$$+\circlearrowleft \Sigma M_{cut} = 0 \Rightarrow M_4 + (8)(x-9) - (23.25)(x-4) + (18\text{ KN})(x-3) = 0$$

$$\boxed{M_4 = -2.75x + 33}$$

$M_{pos} = 8.25\ kN \cdot m$

$M_{neg} = -24\ kN \cdot m$



$$\sigma = -\frac{My}{I}$$

Positive Bending

$$\sigma_1 = -\frac{(8.25\ kN \cdot m)(0.07679\ m)}{7.931 \times 10^{-5}\ m^4} = -8000\ kPa$$

$$= -8\ MPa\ (c)$$

$$\sigma_2 = -\frac{(8.25\ KN\cdot m)(-0.2232m)}{7.931\times10^{-5}m^4} = 23{,}200\ KPa$$

$$= 23.2\ MPa\ (T)$$

Negative Bending

$$\sigma_1 = -\frac{(-24)(0.07679)}{7.931\times10^{-5}} = 23{,}300\ KPa$$

$$= 23.3\ MPa\ (T)$$

$$\sigma_2 = -\frac{(24)(-0.2232)}{7.931\times10^{-5}} = -67{,}600\ KPa$$

$$= -67.6\ MPa\ (C)$$

Max tensile stress = 23.3 MPa
Max compressive stress = 67.6 MPa