5.9) Taking moments about A:

$$45 \times 1.8 \times \tfrac{1}{2} \times 1.8 + (1.8 + 0.9)(120) = R_c(1.8)$$

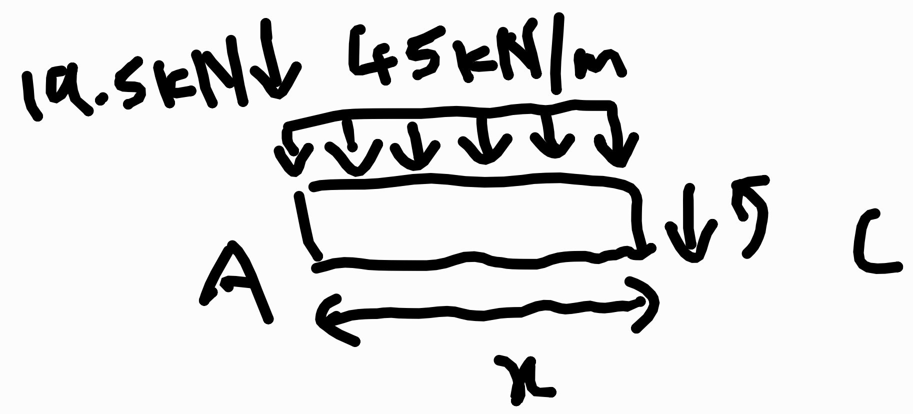
$$R_c = 220.5\,\text{kN}$$

Taking moments about B:

$$0.9(220.5) + R_A(1.8 + 0.9) = (45 \times 1.8)(0.9 + \tfrac{1}{2}(1.8))$$

$$R_A = -19.5\,\text{kN}$$

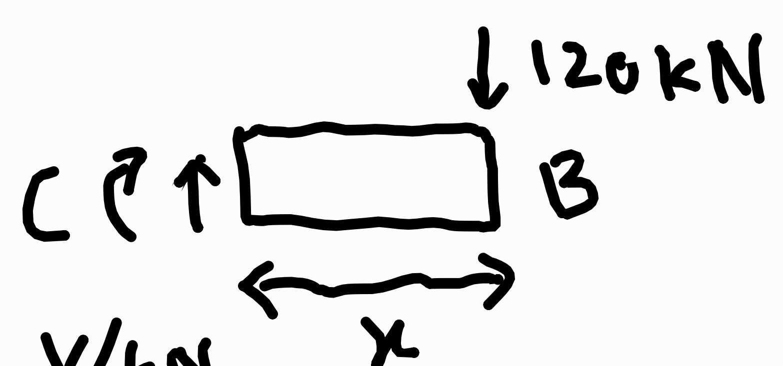
From A to C:



$$V = -19.5 - 45x\ \text{kN}$$

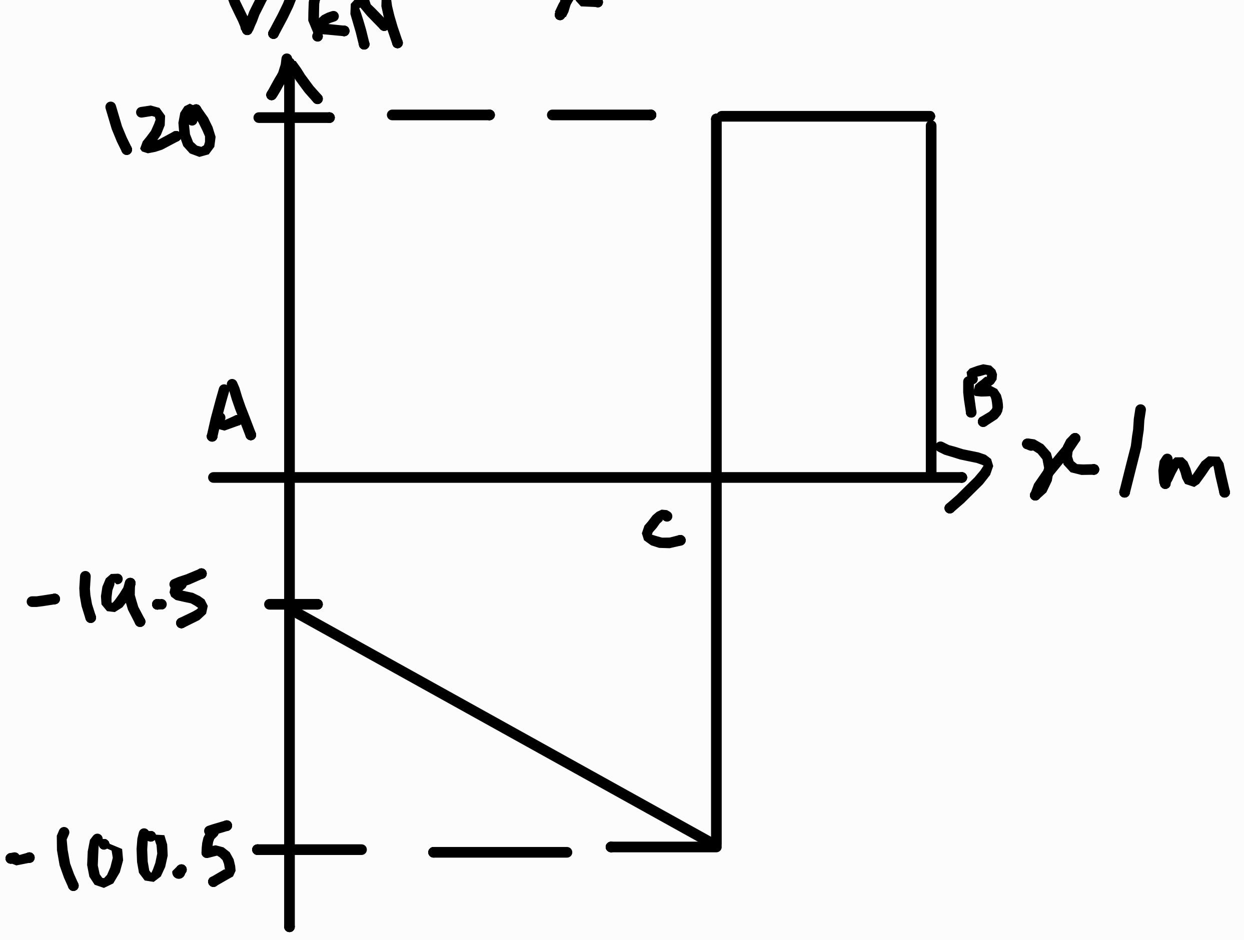
$$M = -19.5x - 22.5x^2\ \text{kNm}$$

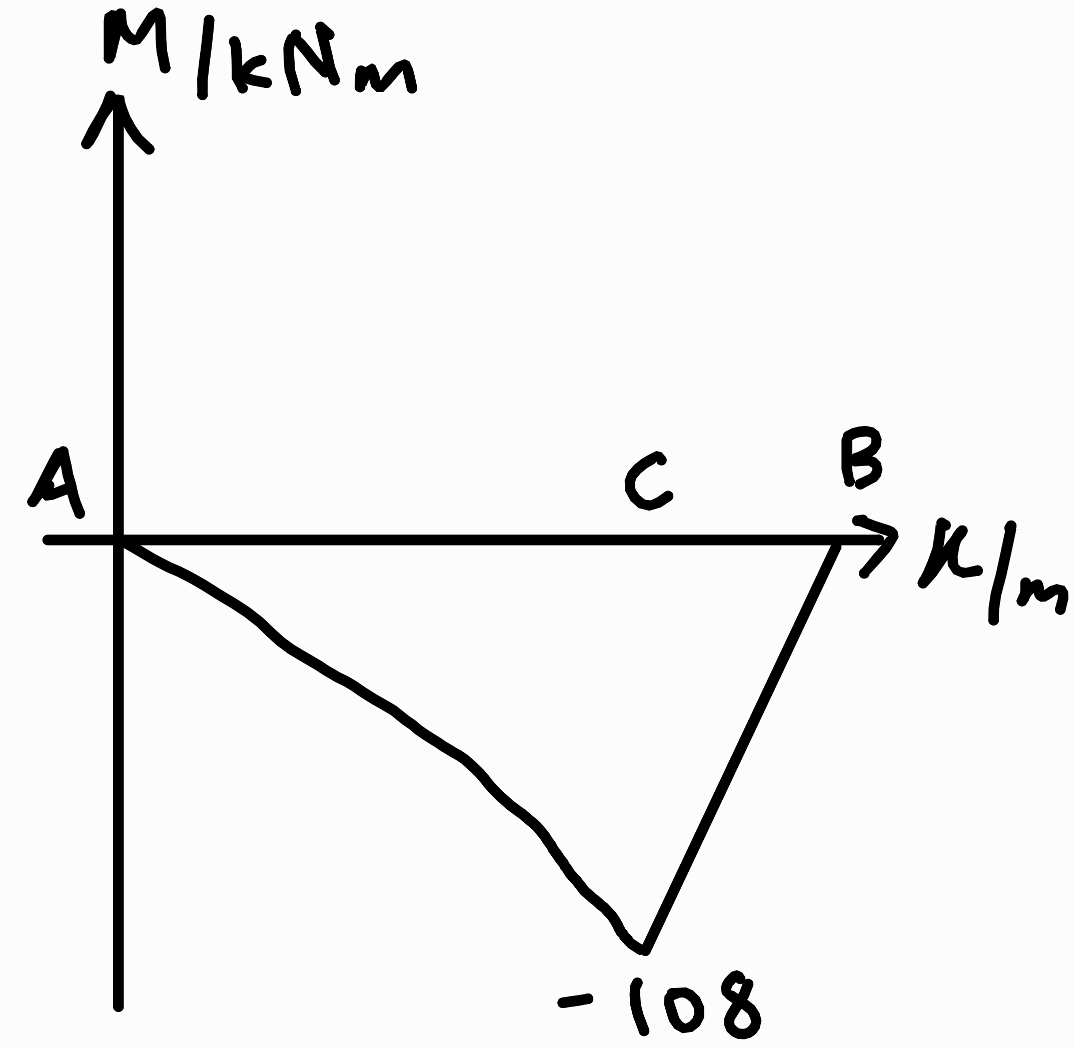
From B to C:



$$V = 120\,\text{kN}$$

$$M = -120x\,\text{kNm}$$





5.11) Taking moments about A:

$F_B = 3 \times 300 + 450 + 3 \times (300 + 400)$

$= 3450 N$

$= 3.45 kN$

Taking moments about B:

$F_A(300 \times 2 + 400) + 450 = 3(300 + 400) + 3(300)$

$F_A = 2.55 kN$

From A to C:

$V = 2.55 kN$

$M = 2.55x\ Nm$

From A to D:

$V = 2.55 - 3 = -0.45 kN$

$M = 2.55x - 3(x - 300)$

$= -0.45x + 900\ Nm$

5.11) From A to E:

$$V = -0.45\,kN$$

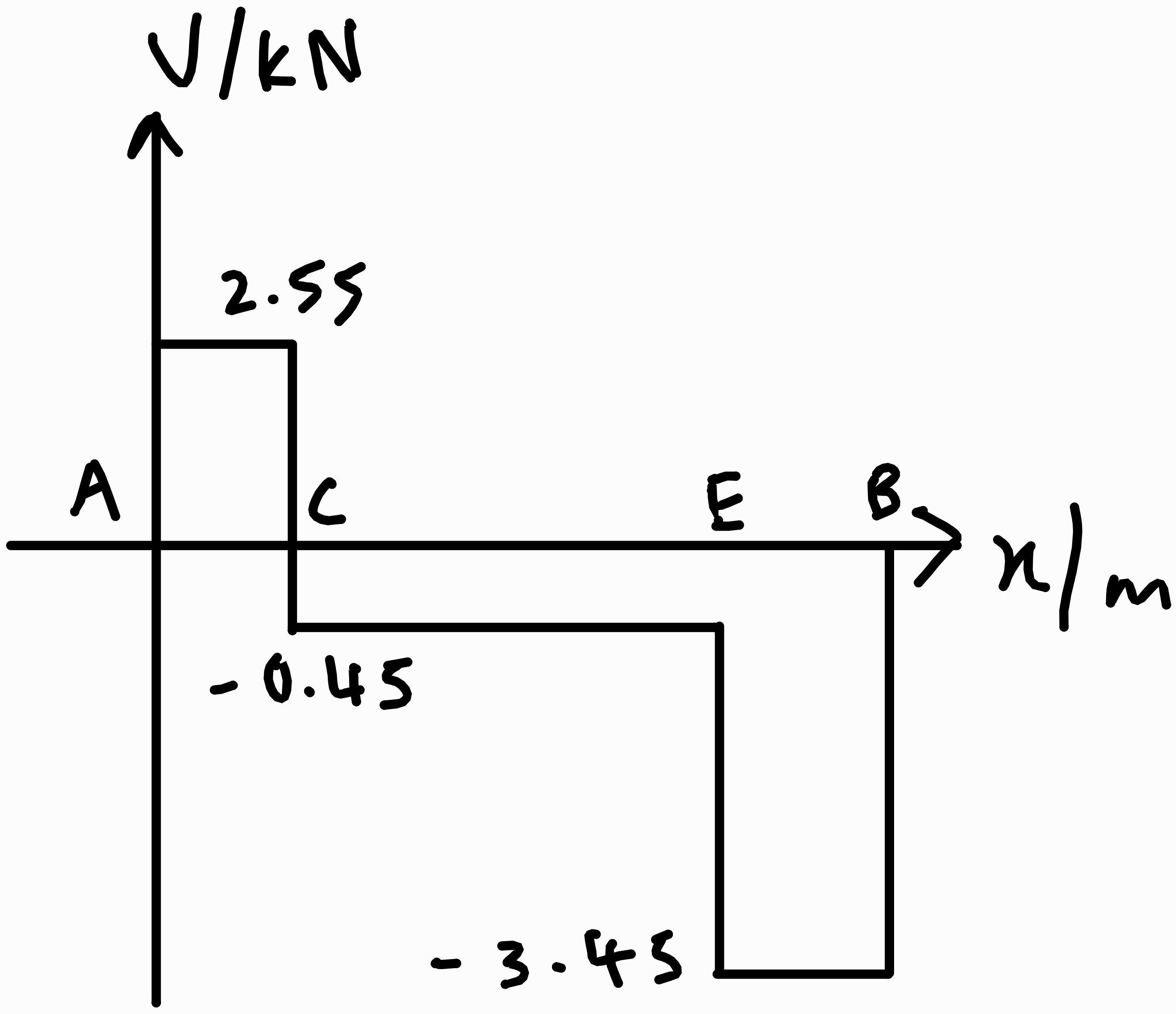
$$M = 2.55x - 3(x-300) + 450$$

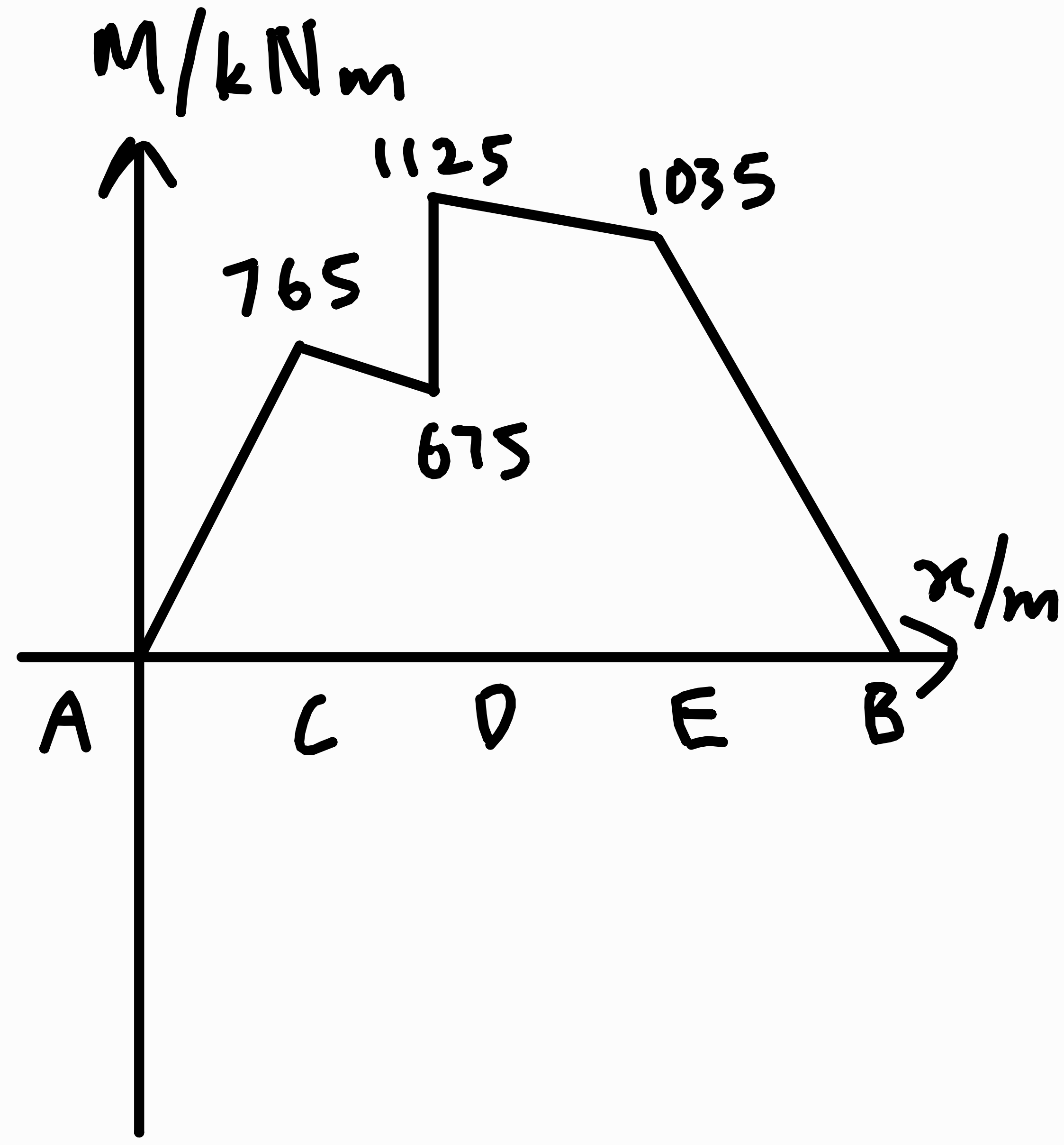
$$= -0.45x + 1350\,Nm$$

From B to E:

$$V = -3.45\,kN$$

$$M = 3.45x\,Nm$$





5.33) Let $w = 7860b^2g$, and $L = 3.6\,m$

Taking moments about C:

$$F_O(1.2) = 7860b^2g(1.8-1.2)$$

$$F_O = 3930b^2g = \frac{w}{2}$$

Taking moments about O:

$$F_C(1.2) = 7860b^2g(1.8-1.2)$$

$$F_C = 3930b^2g = \frac{w}{2}$$

Let X be the midpoint of the bar

From A to C:

$$M = -w\left(\frac{L}{3}\right)\left(\frac{L}{3}\times\frac{1}{2}\right)$$

$$= -\frac{wL^2}{18}$$

From A to X:

$$M = -w\left(\frac{L}{2}\right)\left(\frac{L}{2}\times\frac{1}{2}\right) + \frac{w}{2}\left(\frac{L}{3}\right)$$

$$= -\frac{wL^2}{24}$$

$$\therefore \sigma_{max} = \frac{\frac{wL^2}{18}\times\frac{1}{2}\cancel{b}}{\frac{1}{12}b\cancel{b}^{3}}$$

$$= \frac{wL^2}{3b^3}$$

5.33a) When $\sigma_{max} = 10\,MPa$,

$$10 \times 10^6 = \frac{wL^2}{3b^3}$$

$$10 \times 10^6 = \frac{7860 \cancel{b^2} g (3.6)^2}{3b^{\cancel{3}}}$$

$$b = 33.3100512\,mm$$

$$\approx 33.3\,mm$$

b) When $\sigma_{max} = 50\,MPa$,

$$50 \times 10^6 = \frac{wL^2}{3b^3}$$

$$50 \times 10^6 = \frac{7860 \cancel{b^2} g (3.6)^2}{3b^{\cancel{3}}}$$

$$b = 6.66201024\,mm$$

$$\approx 6.66\,mm$$

5.65) Let $L = 2.4$ m

Taking moments about A:

$$F_D L = 1.8\left(\frac{L}{3}\right) + 3.6\left(\frac{2L}{3}\right)$$

$$F_D = 3\text{kN}$$

Taking moments about D:

$$F_A L = 1.8\left(\frac{2L}{3}\right) + 3.6\left(\frac{L}{3}\right)$$

$$F_A = 2.4\text{kN}$$

From A to B:

$$M = 2.4\left(\frac{L}{3}\right)$$

$$= 0.8L\text{kNm}$$

From A to C:

$$M = 2.4\left(\frac{2L}{3}\right) - 1.8\left(\frac{L}{3}\right)$$

$$= L\text{kNm}$$

5.65) $\sigma_{max} = \frac{My}{I}$

$$12\times10^6 = \frac{L\left(\frac{\cancel{h}}{2}\right)\times10^3}{\frac{1}{12}(40\times10^{-3})h^{\cancel{3}2}}$$

$$12\times10^6 h^2 = 150L\times10^3$$

$$h = \sqrt{\frac{150\times2.4\times10^3}{12\times10^6}}$$

$$h = 0.173205080\,8\,m$$

$$\approx 173.2\,mm$$