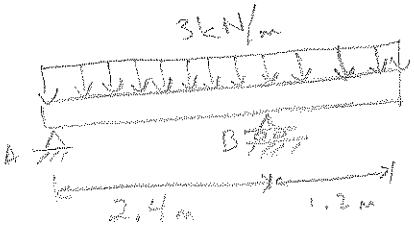
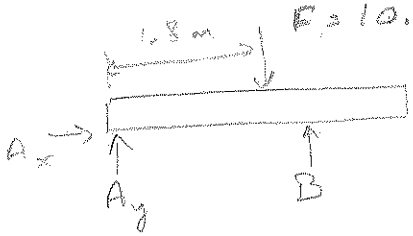
12.61 Design cross-section for max normal stress of 1750 psi, i.e. Find 'b' for $\sigma_{max} = 1750$ psi





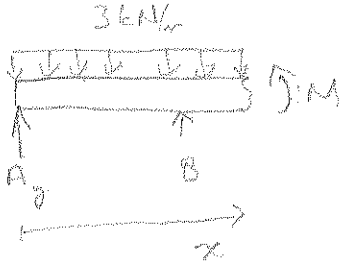
$$F = (3\,kN/m)(3.6\,m) = 10.8\,kN$$

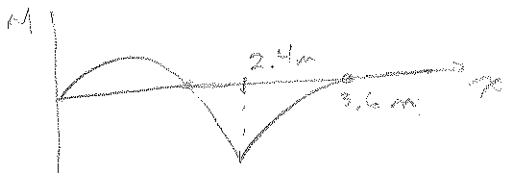
$$\sum F_x \Rightarrow A_x = 0$$

$$\sum M_{/A} \Rightarrow B = \frac{(10.8\,kN)(1.8\,m)}{2.4\,m}$$

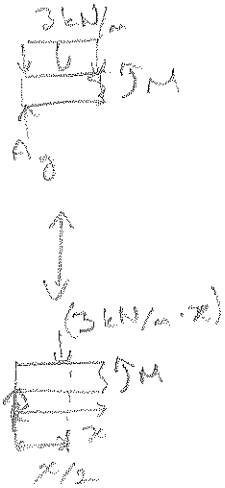
$$B = 8.1\,kN$$

$$\sum F_y \Rightarrow A_y = F - B$$
$$= 10.8\,kN - 8.1\,kN$$
$$= 2.7\,kN$$





|M| greatest at peak of parabola between $0 < x < 2.4$ m or at $x = 2.4$ m.



for $0 < x < 2.4$ m

$$M = A_y x - 3\,kN/m \cdot x\left(\frac{x}{2}\right)$$
$$= 2.7\,kN \cdot x - 1.5\,kN/m \cdot x^2$$

$$\frac{dM}{dx} = 2.7\,kN - 3\,kN/m \cdot x = 0$$

$$\Rightarrow x = 0.9\,m$$

12.61 cont'd

max $|M|$ occurs @

$x = 0.9\,m$ or $x = 2.4\,m$

for $0 < x < 2.4\,m$

$$M(x) = (2.7\,kN)x - (1.5\,kN/m)x^2$$

$$M(0.9\,m) = 1.215\,kN\cdot m$$

$$M(2.4\,m) = -2.16\,kN\cdot m$$

$$\max |M| = 2.16\,kN\cdot m$$

$$\sigma_{max} = \frac{-My}{I} = \frac{(2.16\,kN)(0.075\,m)}{\frac{1}{12}(0.15\,m)^3\,b} = 12\,MPa$$

$$b = \frac{(2.16\,kN)(0.075\,m)}{(0.15\,m)^3(1\,MPa)}$$

$$\boxed{b = 48\,mm}$$