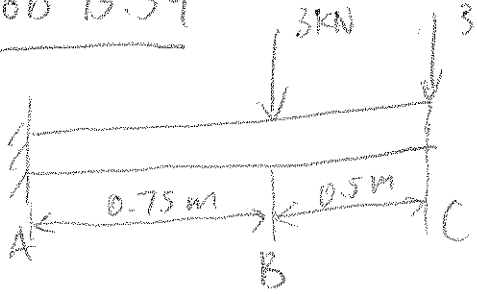
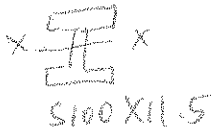
Prob 15.59





$E = 200\ GPa$

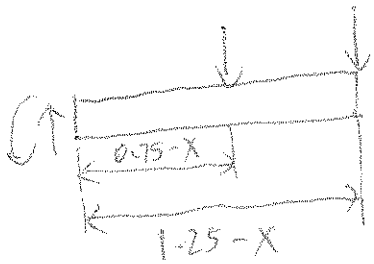
Find y and θ at B

From Appendix

S100x11.5 Beam

$I_x = 2.52 \times 10^6\ mm^4 = 2.52 \times 10^{-6}\ m^4$

Differential Equation



$0 \le x \le 0.75$

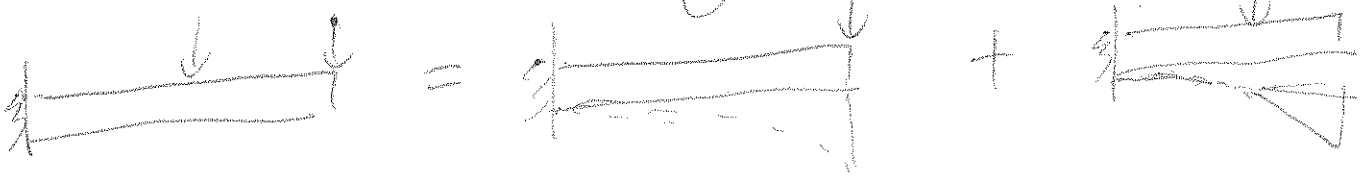
$$M(x) = -3000(0.75 - x) - 3000(1.25 - x)$$
$$= 6000x - 6000$$
$$EI\frac{d^2y}{dx^2} = M(x)$$
$$EI\frac{dy}{dx} = 3000x^2 - 6000x + C$$
$$\left.\frac{dy}{dx}\right|_{x=0} = 0 \quad \text{so} \quad C = 0$$
$$\theta(x) = \frac{dy}{dx} = \frac{1}{EI}(3000x^2 - 6000x)$$
$$y(x) = \frac{1}{EI}(1000x^3 - 3000x^2 + C_1)$$
$$y(0) = 0 \Rightarrow C_1 = 0$$
$$\text{So } y(x) = \frac{1}{EI}(1000x^3 - 3000x^2)$$

At B, $x = 0.75\ m$

$$\theta_B = \theta(0.75) = -5.58 \times 10^{-3}\ rad \quad \curvearrowright$$
$$y_B = y(0.75) = -2.51\ mm \quad \downarrow$$

Prob 15.59

Method 2.



Part ① $y_1 = \frac{-PL_1^3}{3EI} = -\frac{3000 \cdot (1.25)^3}{3(200\text{GPa})(2.25\times10^{-6}\text{m}^4)}$

$\theta_1 = \frac{-PL_1^2}{2EI} = \frac{-3000 \cdot (1.25)^2}{2(200\text{GPa})(2.25\times10^{-6}\text{m}^4)}$

Part ② $y_2 = \frac{-PL_2^3}{3EI} = -\frac{3000(0.75)^3}{3(200\text{GPa})(2.25\times10^{-6}\text{m}^4)}$

$\theta_2 = \frac{-PL_2^2}{2EI} = \frac{-3000(0.75)^2}{2(200\text{GPa})(2.25\times10^{-6}\text{m}^4)}$

$y = y_1 + y_2 = -2.51\text{mm}$

$\theta = \theta_1 + \theta_2 = -5.58\times10^{-3}\text{ rad}$