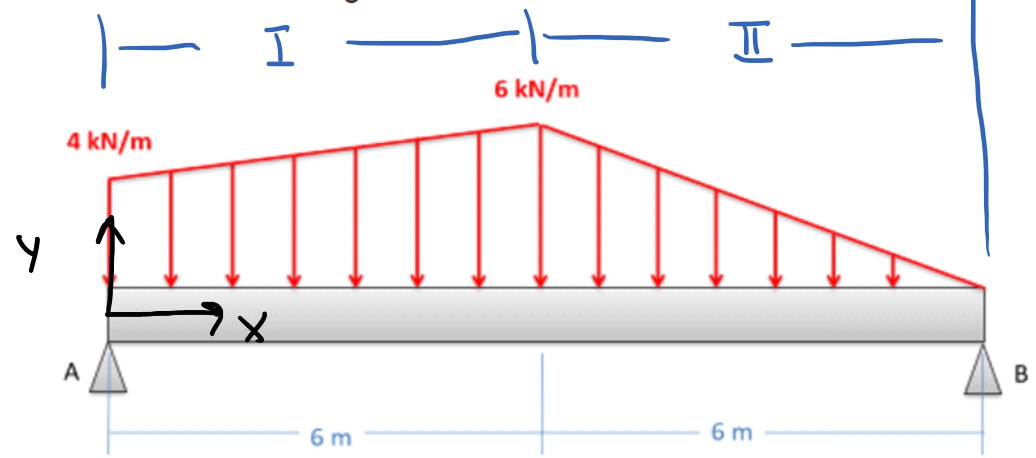
Problem 5

Determine the magnitude and location of the equivalent point load, then use that to find the magnitude of the reaction forces at A and B.



$$F(x)_{I} = \frac{1}{3}x + 4 \qquad F(x)_{II} = -x + 12$$

$$F_{eq} = \int_0^6 \frac{1}{3}x + 4 \quad + \quad \int_6^{12} -x + 12$$

$$F_{eq} = \left(\frac{1}{6}x^2 + 4x\right)\Big|_0^6 + \left(-\frac{1}{2}x^2 + 12x\right)\Big|_6^{12}$$

$$F_{eq} = \left(\frac{1}{6}(6)^2 + 4(6)\right) - (0) + \left(-\frac{1}{2}(12)^2 + (12)(12)\right) - \left(-\frac{1}{2}(6)^2 + 12(6)\right)$$

$$F_{eq} = 30 - 0 + 72 - 54$$

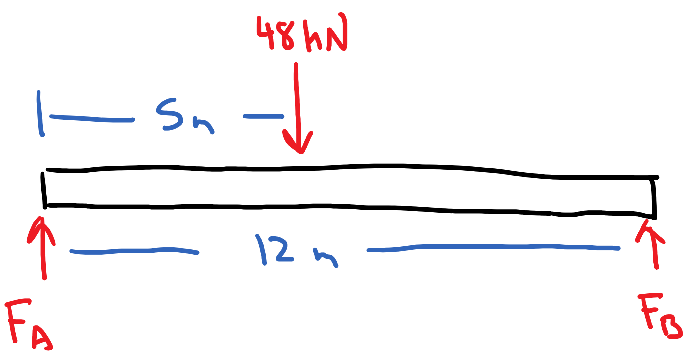
$$\underline{F_{eq} = 48 \text{ kN}}$$

$$x_{eq} = \frac{\int_0^6 \left(\frac{1}{3}x + 4\right)(x) + \int_6^{12} (-x+12)(x)}{F_{eq}}$$

$$x_{eq} = \frac{\int_0^6 \left(\frac{1}{3}x^2 + 4x\right) + \int_6^{12} \left(-x^2 + 12x\right)}{48}$$

$$x_{eq} = \frac{\left(\frac{1}{9}x^3 + 2x^2\right)\Big|_0^6 + \left(-\frac{1}{3}x^3 + 6x^2\right)\Big|_6^{12}}{48}$$

$$x_{eq} = \frac{96 - 0 + 288 - 144}{48} = \underline{5\text{ m}}$$



$$\Sigma F_y = F_A + F_B - 48 = 0$$

$$\Sigma M_A = -(48)(5) + (F_B)(12) = 0$$

$$F_B = \frac{(48)(5)}{12} = 20\text{ kN}$$

$$F_A = 48 - 20 = 28\text{ kN}$$

$$\boxed{F_A = 28\text{ kN}} \qquad \boxed{F_B = 20\text{ kN}}$$