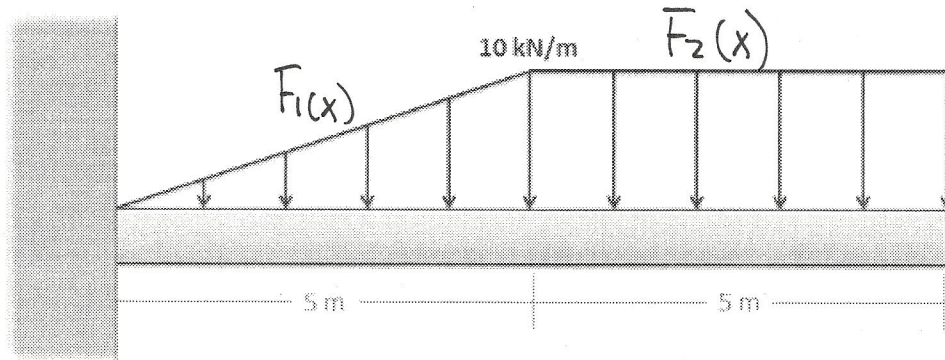## Question 3:

Determine the magnitude and the point of application for the equivalent
point load of the distributed force shown below.

$$F_1(x) = 2x$$

$$F_2(x) = 10$$

$$F_{eq} = \int_0^5 2x \, dx + \int_5^{10} 10 \, dx$$

$$F_{eq} = \left|_0^5 x^2 + \right|_5^{10} 10x$$

$$F_{eq} = \left((5)^2 - (0)^2 \right) + \left(10(10) - 10(5) \right)$$

$$25 \qquad + \qquad 50$$

$$F_{eq} = 75 \, hN$$

$$X_{eq} = \frac{\int_0^5 (2x)(x)\,dx + \int_5^{10}(10)(x)\,dx}{F_{eq}}$$

$$\int_0^5 2x^2\,dx + \int_5^{10} 10x\,dx$$

$$\Big|_0^5 \frac{2}{3}x^3 + \Big|_5^{10} 5x^2$$

$$\left(\frac{2}{3}(5)^3 - \frac{2}{3}(0)^3\right) + \left(5(10)^2 - 5(5)^2\right)$$

$$83.33 \qquad\qquad\qquad 375$$

$$X_{eq} = \frac{(83.33 + 375)(kN/m)(m^2)}{75\,kN}$$

$$X_{eq} = 6.11\,m$$

Solution:

$F_{eq} = 75\,kN$

$X_{eq} = 6.11m$