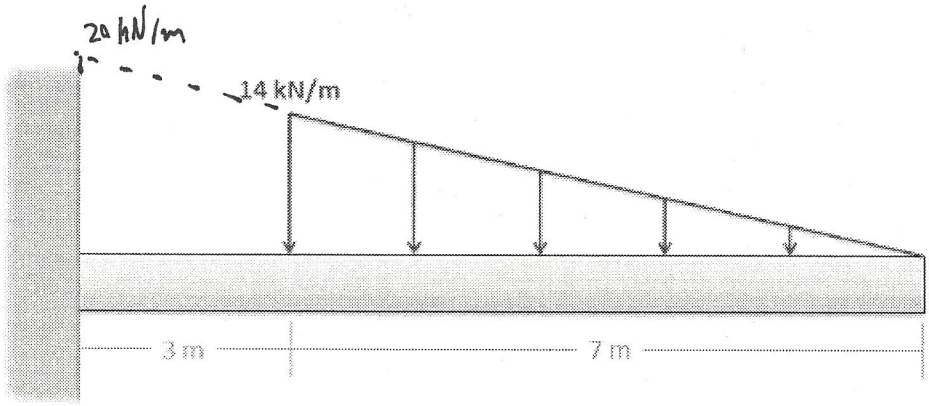
Question 1:

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



Calculations:

$$F_{(x)} = -2x + 20$$

$$F_{eq} = \int_3^{10} (-2x + 20)\, dx$$

$$F_{eq} = \Big|_3^{10} -x^2 + 20x$$

$$F_{eq} = \underset{100}{\left(-10^2 + 20(10)\right)} - \underset{51}{\left(-3^2 + 20(3)\right)}$$

$$F_{eq} = 49\ kN$$

$$X_{eq} = \frac{\int_3^{10} (-2x + 20)(x)\, dx}{F_{eq}}$$

$$\int_3^{10} -2x^2 + 20x \, dx$$

$$\downarrow$$

$$\left| \begin{matrix} 10 \\ 3 \end{matrix} \right. -\frac{2}{3}x^3 + 10x^2$$

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

$$333.33 \quad - \quad 72$$

$$261.33$$

$$X_{eq} = \frac{261.33 \text{ kNm}}{49 \text{ kN}}$$

$$X_{eq} = 5.33 \text{ m}$$

Solution