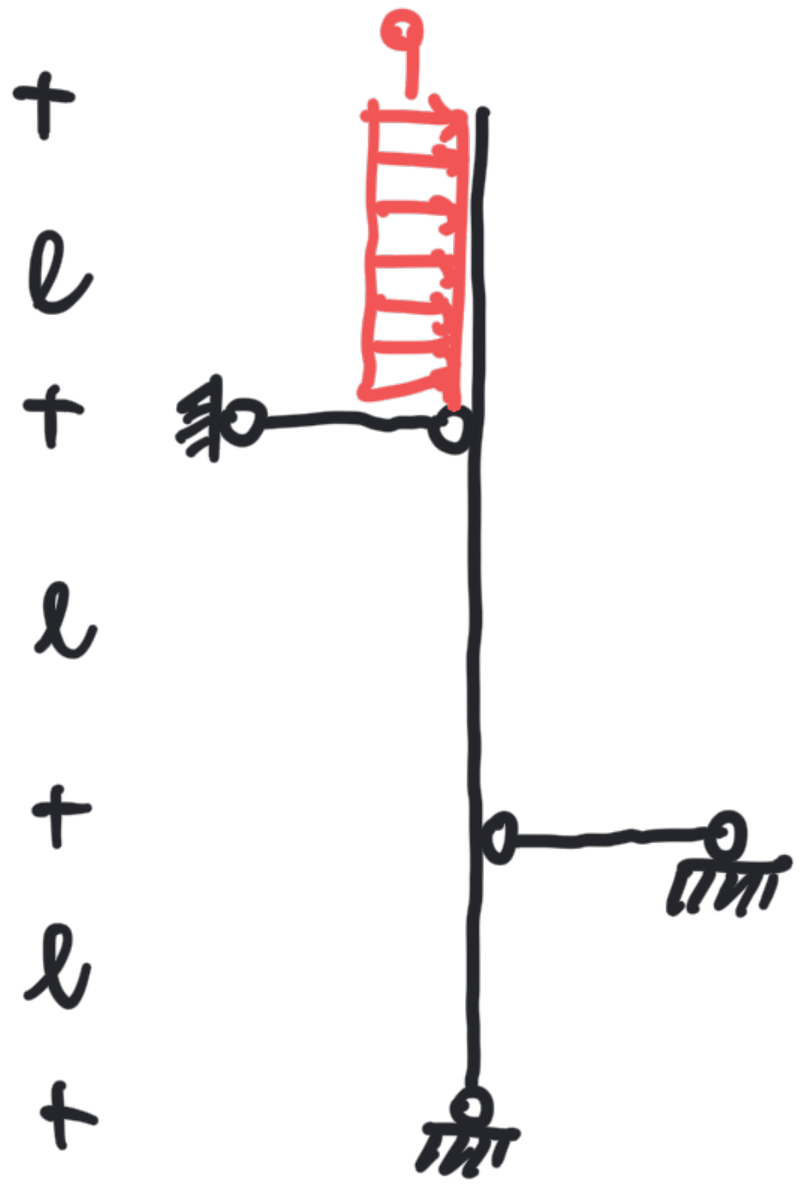
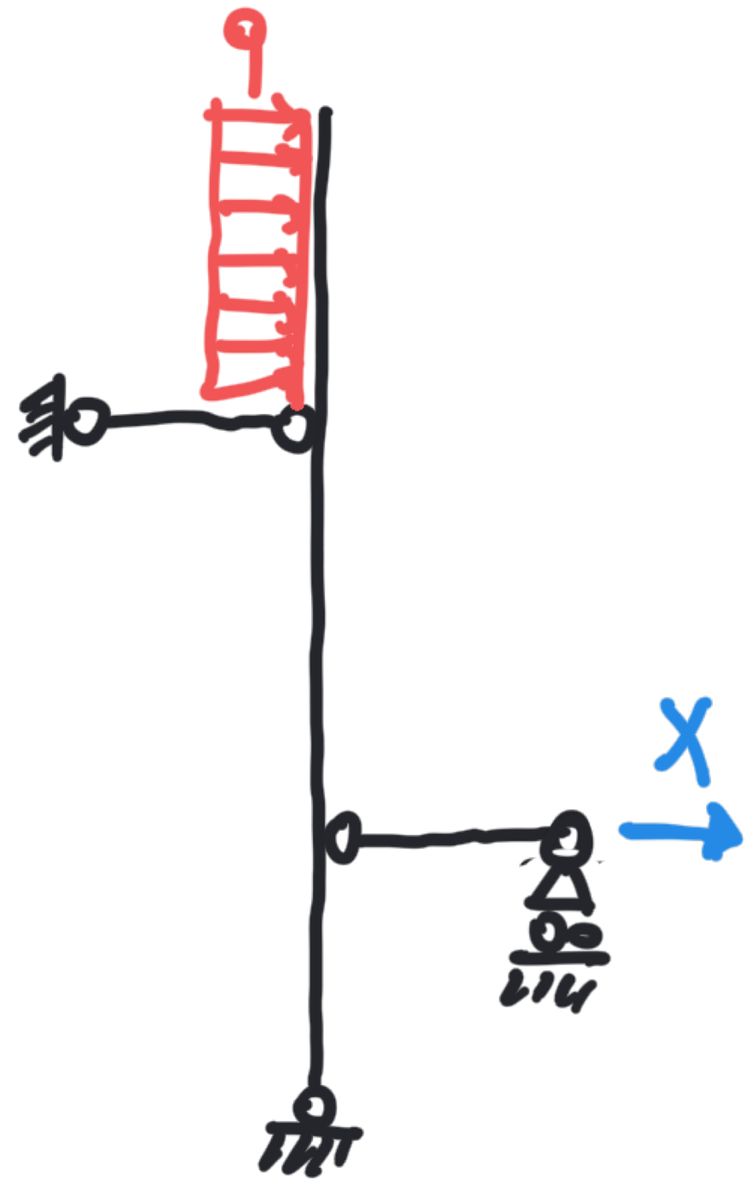
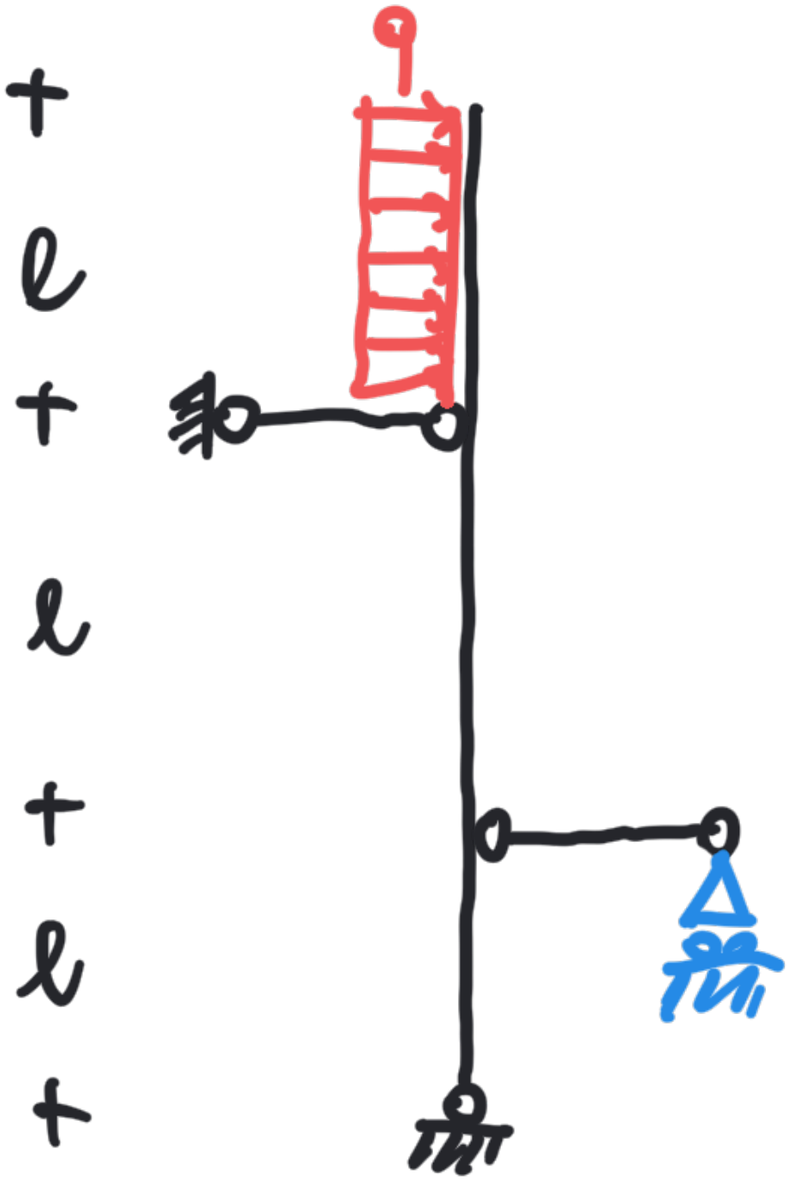
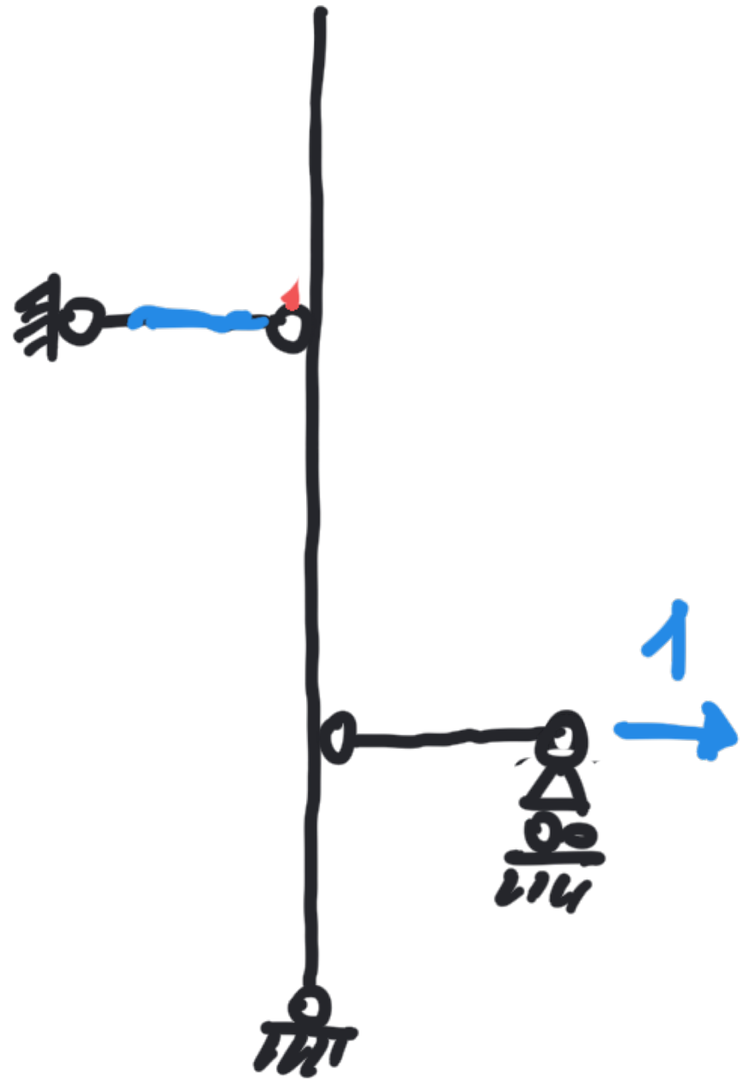

q
l
l
l

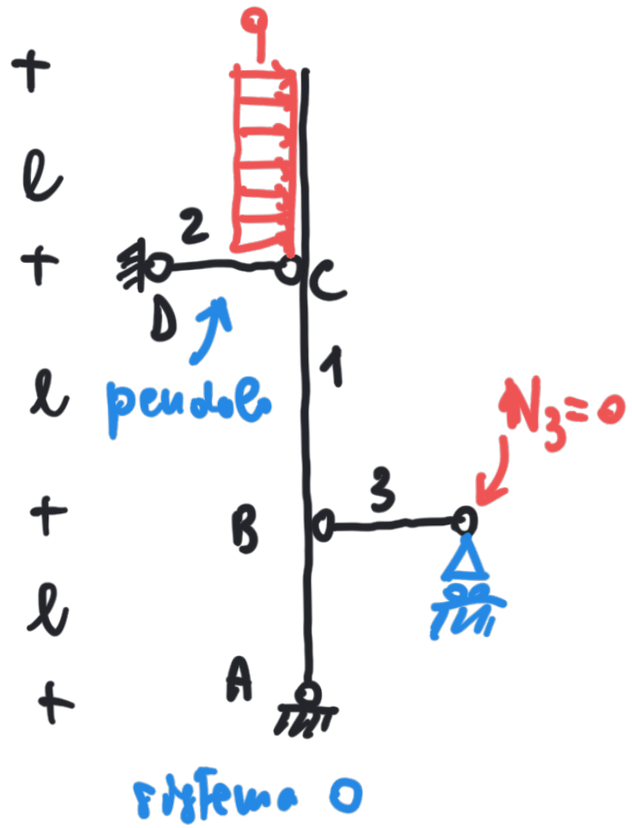

q
X

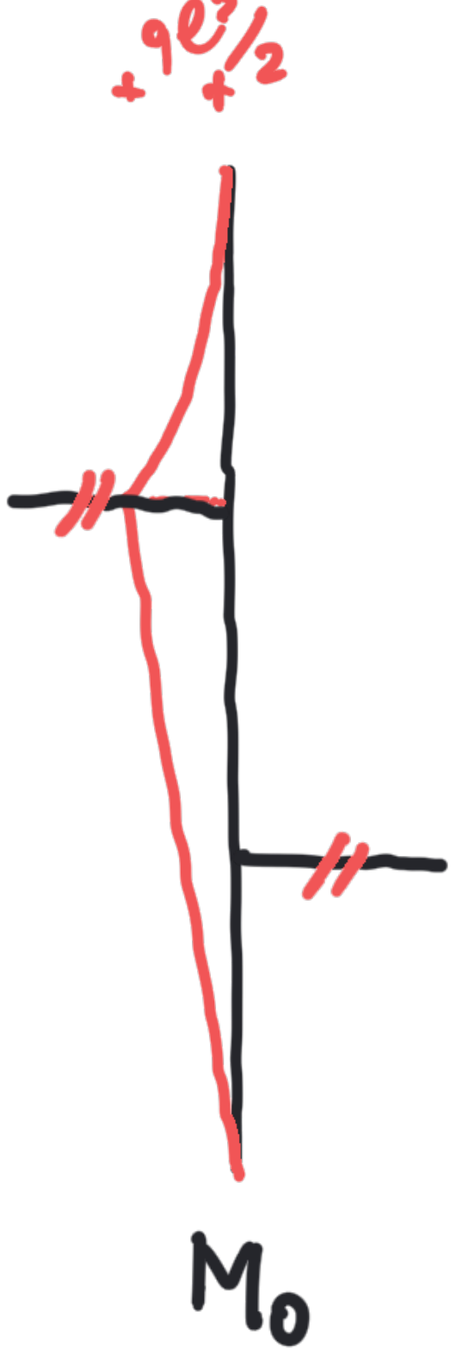


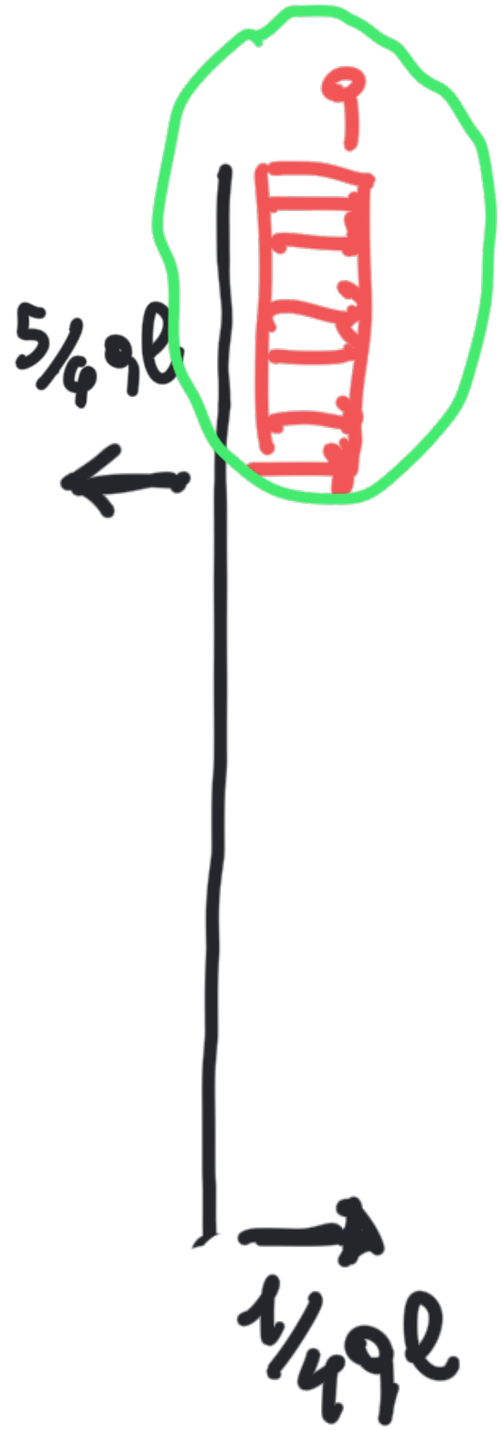

Sistema 0




Sistema 1

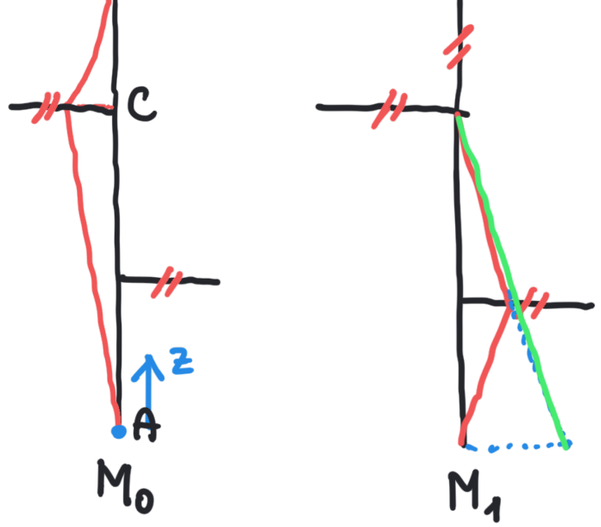



$M_A=0$

$$2\ell N_2 - q\ell\left(\tfrac{1}{2}+2\right)\ell = 0 \quad \overset{5/2}{\Rightarrow} \quad N_1 = \frac{5}{4}q\ell$$







$0 < z < \ell$

$M_1(z) = z/2$

$\ell < z < 2\ell$

$M_1(z) = \ell - z/2$

$$\int_0^{2\ell} M_0(z) M_1(z)\,dz = \int_0^{\ell} -\frac{3\ell}{4} z \cdot \frac{z}{2} + \int_{\ell}^{2\ell} -\frac{3\ell}{4} z \cdot (\ell - z/2)$$

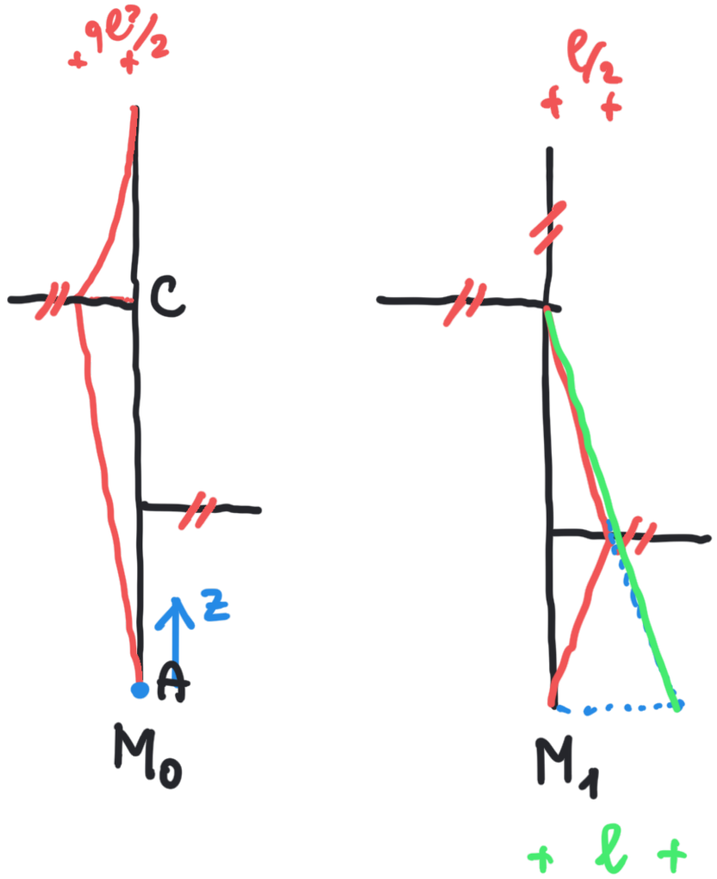
$$= -\frac{3\ell}{4}\left(\frac{1}{2} z^3/3 \Big|_0^{\ell} + \ell \cdot z^2/2 \Big|_{\ell}^{2\ell} - \frac{1}{2} z^3/3 \Big|_{\ell}^{2\ell}\right)$$

$$= -\frac{9\ell}{4}\left(\frac{1}{2}\frac{\ell^3}{3} + \ell\left(\frac{4\ell^2}{2} - \frac{\ell^2}{2}\right) - \frac{1}{2}\left(\frac{8\ell^3}{3} - \frac{\ell^3}{3}\right)\right)$$

$$= -\frac{9\ell^4}{4}\left(\frac{1}{6} + 2 - \frac{1}{2} - \frac{1}{2}\left(\frac{8}{3} - \frac{1}{3}\right)\right)$$

$$= -\frac{9\ell^4}{4}\left(\frac{1}{6} + \frac{12}{6} - \frac{3}{6} - \frac{7}{6}\right) = -\frac{9\ell^4}{4}\,\frac{1}{2} = -\frac{9\ell^4}{8}$$

$$X = -\frac{-\frac{9\ell^4}{8}}{\int M_1^2}$$




$$M_0(z) = \alpha z = -\frac{ql}{4} z$$

$$0 < z < l$$

$$M_1(z) = z/2$$

$$l < z < 2l$$

$$M_1(z) = l - z/2$$

$$X = -\frac{-\frac{ql^4}{8}}{\int M_1^2}$$