47. The charge dq within a thin section of the rod (of thickness dx) is $\rho\, A\, dx$ where $A = 4.00 \times 10^{-4}$ m^2 and ρ is the charge per unit volume. The number of (excess) electrons in the rod (of length $L = 2.00$ m) is $N = q/(-e)$ where e is given in Eq. 22-14.

(a) In the case where $\rho = -4.00 \times 10^{-6}$ C/m^3, we have

$$N = \frac{q}{-e} = \frac{\rho\, A}{-e} \int_0^L dx = \frac{|\rho|\, A\, L}{e}$$

which yields $N = 2.00 \times 10^{10}$.

(b) With $\rho = bx^2$ ($b = -2.00 \times 10^{-6}$ C/m^5) we obtain

$$N = \frac{b\, A}{-e} \int_0^L x^2\, dx = \frac{|b|\, A\, L^3}{3\, e} = 1.33 \times 10^{10}\ .$$