

21. We denote the inner and outer cylinders with subscripts i and o , respectively.

(a) Since $r_i < r = 4.0 \text{ cm} < r_o$,

$$E(r) = \frac{\lambda_i}{2\pi\epsilon_0 r} = \frac{5.0 \times 10^{-6} \text{ C/m}}{2\pi (8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2) (4.0 \times 10^{-2} \text{ m})} = 2.3 \times 10^6 \text{ N/C} .$$

$\vec{E}(r)$ points radially outward.

(b) Since $r > r_o$,

$$E(r) = \frac{\lambda_i + \lambda_o}{2\pi\epsilon_0 r} = \frac{5.0 \times 10^{-6} \text{ C/m} - 7.0 \times 10^{-6} \text{ C/m}}{2\pi (8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2) (8.0 \times 10^{-2} \text{ m})} = -4.5 \times 10^5 \text{ N/C} ,$$

where the minus sign indicates that $\vec{E}(r)$ points radially inward.