35. (a) According to the result of problem 28, the electric potential at a point with coordinate x is given by

$$V = \frac{Q}{4\pi\varepsilon_0 L} \ln\left(\frac{x-L}{x}\right) .$$

We differentiate the potential with respect to x to find the x component of the electric field:

$$\begin{aligned} E_x &= -\frac{\partial V}{\partial x} = -\frac{Q}{4\pi\varepsilon_0 L} \frac{\partial}{\partial x} \ln\left(\frac{x-L}{x}\right) = -\frac{Q}{4\pi\varepsilon_0 L} \frac{x}{x-L} \left(\frac{1}{x} - \frac{x-L}{x^2}\right) \\ &= -\frac{Q}{4\pi\varepsilon_0 x(x-L)} . \end{aligned}$$

At $x = -d$ we obtain

$$E_x = -\frac{Q}{4\pi\varepsilon_0 d(d+L)} .$$

(b) Consider two points an equal infinitesimal distance on either side of P_1, along a line that is perpendicular to the x axis. The difference in the electric potential divided by their separation gives the transverse component of the electric field. Since the two points are situated symmetrically with respect to the rod, their potentials are the same and the potential difference is zero. Thus the transverse component of the electric field is zero.