82. The part of R_0 connected in parallel with R is given by $R_1 = R_0 x/L$, where $L = 10\,\text{cm}$. The voltage difference across R is then $V_R = \mathcal{E}R'/R_{\text{eq}}$, where $R' = RR_1/(R+R_1)$ and $R_{\text{eq}} = R_0(1-x/L) + R'$. Thus

$$P_R = \frac{V_R^2}{R} = \frac{1}{R}\left(\frac{\mathcal{E}RR_1/(R+R_1)}{R_0(1-x/L) + RR_1/(R+R_1)}\right)^2 .$$

Algebraic manipulation then leads to

$$P_R = \frac{100R(\mathcal{E}x/R_0)^2}{(100R/R_0 + 10x - x^2)^2}$$

where x is measured in cm.